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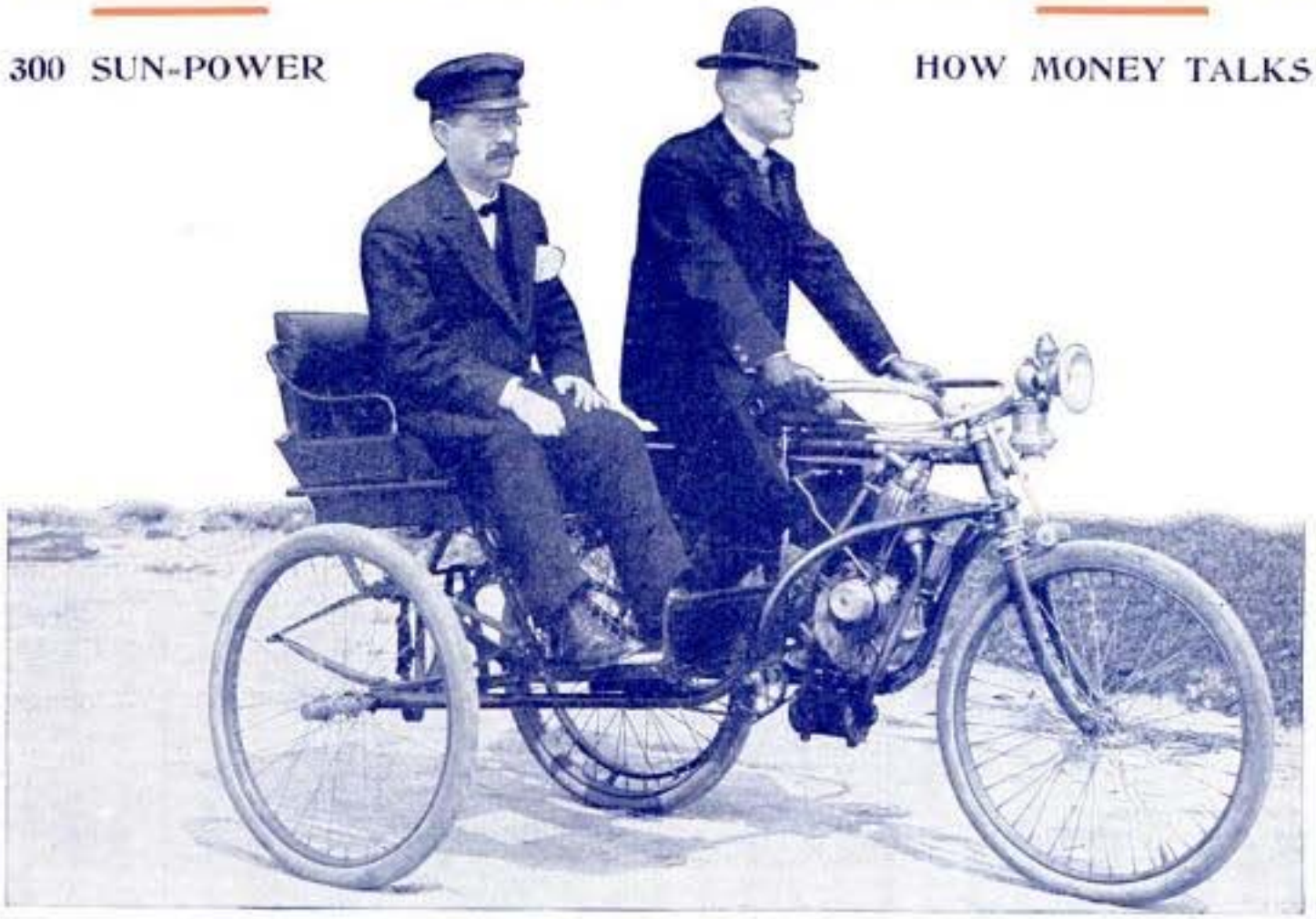

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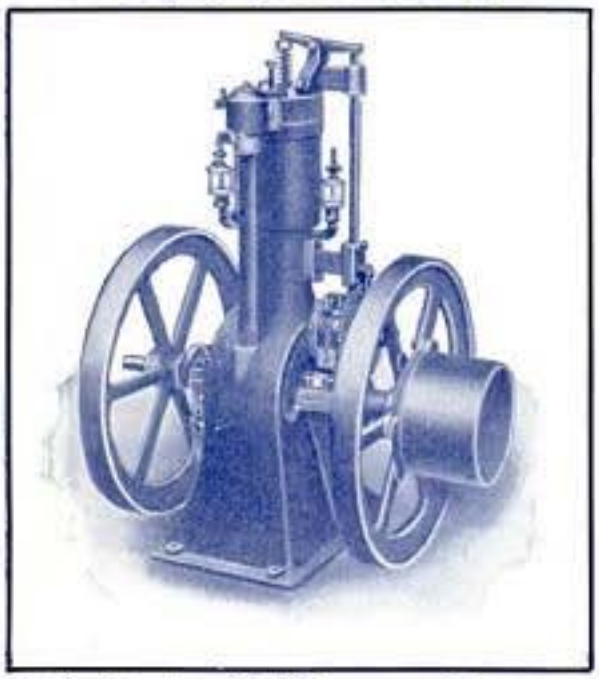

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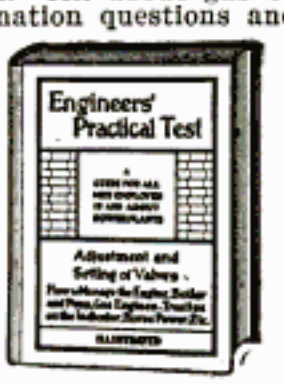

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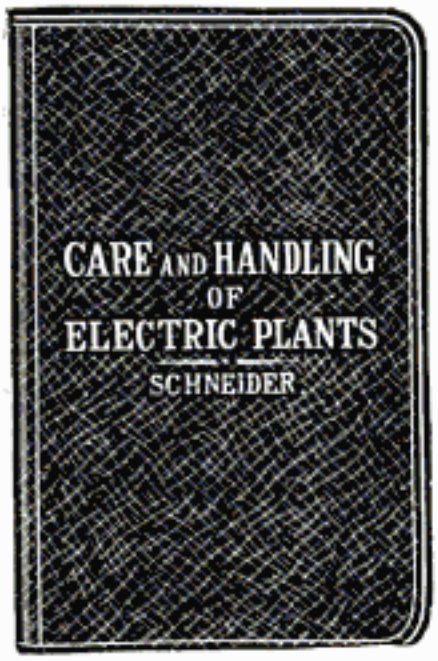

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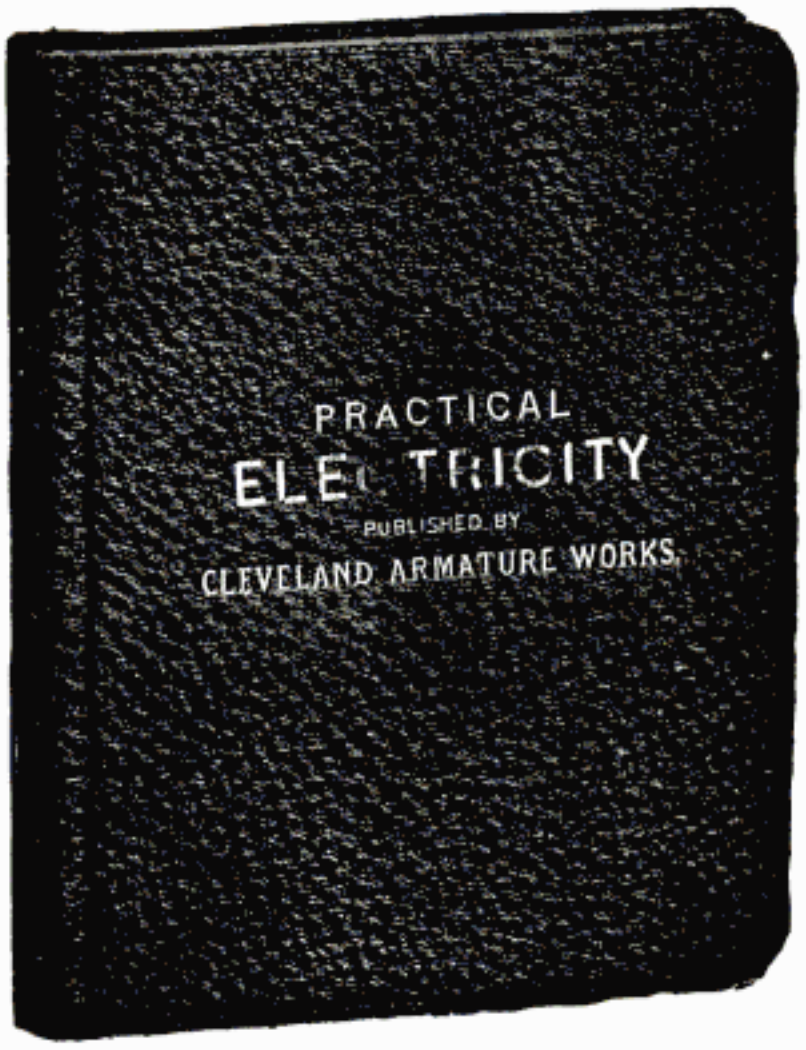

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Vol. 7. No. 8. CHICAGO, AUGUST, 1905. 10 Cents a copy $1.00 a year

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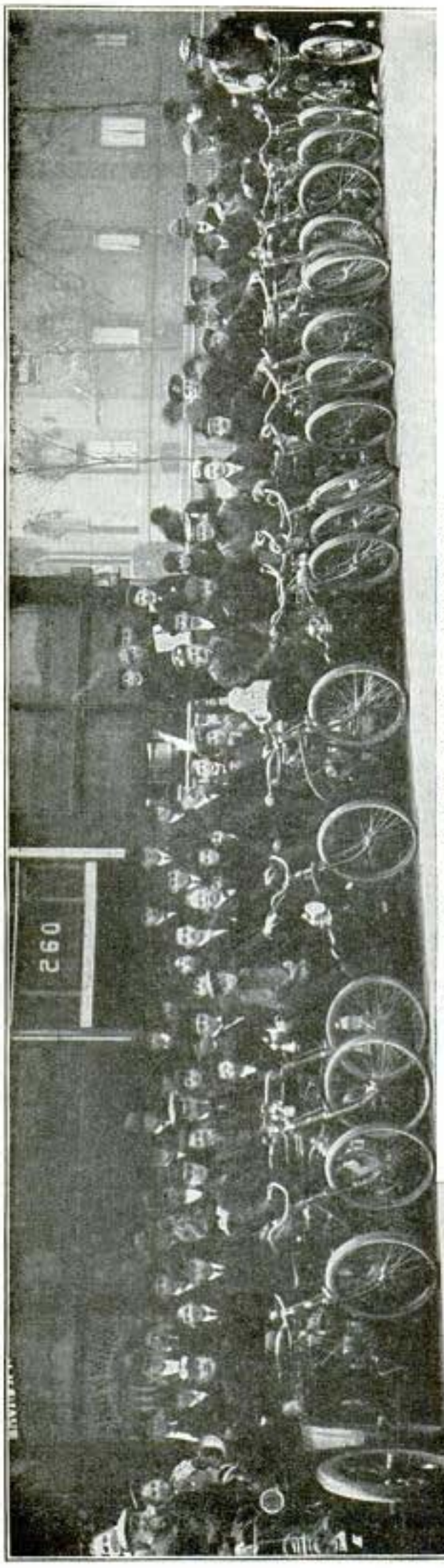
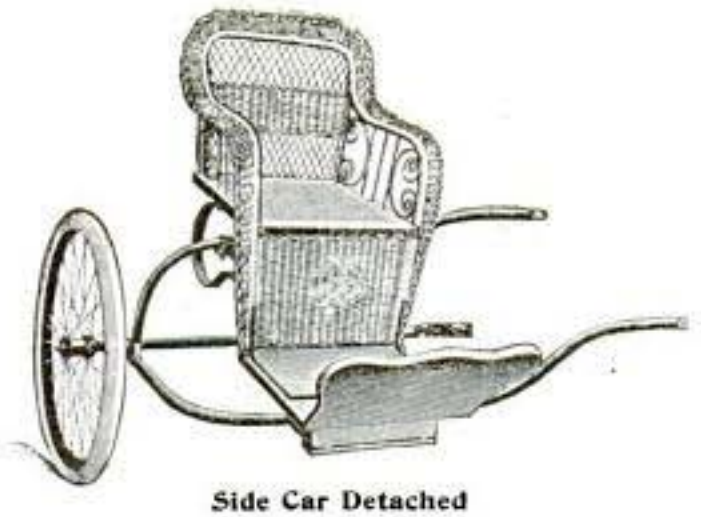
The machine illustrated weighs 175 lbs. and will carry a load of passengers or freight up to nearly 400 lbs. The gasoline

Solid Comfort in the Motorcycle Side Seat Car---St. Croix Johnston, Motorcycle Racer, Driving; I. H. Whipple, Motorcycle Expert, in Side Car



Chicago Motorcycle Club Starting on 100-Mile Run



Side Car Detached

engine is of 2¼ h. p. and makes 2,500 revolutions per minute. Almost the entire weight is carried on the rear driving wheel, which is made stronger than the others. The front and side wheels are idlers. A gasoline supply for 60 miles is carried; the machine will cover 30 miles an hour on fairly level roads, and is also a good hill climber.

The rear axle is hollow and telescopes. This enables the operator to reduce his wheel gauge to the smallest limit for city use, so as to wind in and out among other vehicles and take advantage of small openings where larger machines would be blocked. When out on country highways the axle draws out to conform to the two traveled paths. The change is made in a moment by means of a set screw. The wheels are 28 in. diameter, pneumatic; the engine is air cooled and started with the pedals. An effective brake is shown on the forward wheel in front of the fork. The drive is a sprocket chain, but avoids the disagreeable vibration heretofore incident to sprocket chains by use of a special friction clamp; this saves the tension of a rope drive, but preserves its good qualities with the obvious advantages of the sprocket.

The side seat is carried on two elliptic springs, which, with pneumatic tires, gives very easy riding even at high speed. When

Side Car Attached

desired, the "side car" can be detached and the machine used as an ordinary motorcycle. How this is done is shown in the cut. The motorcycle side car is thus far the nearest approach to the low priced automobile which the newspapers heralded two years ago as in process of invention by Thomas Edison, but which did not materialize.

The motorcycle side car is already frequently seen on the boulevards and in the parks and bids fair to be very popular.

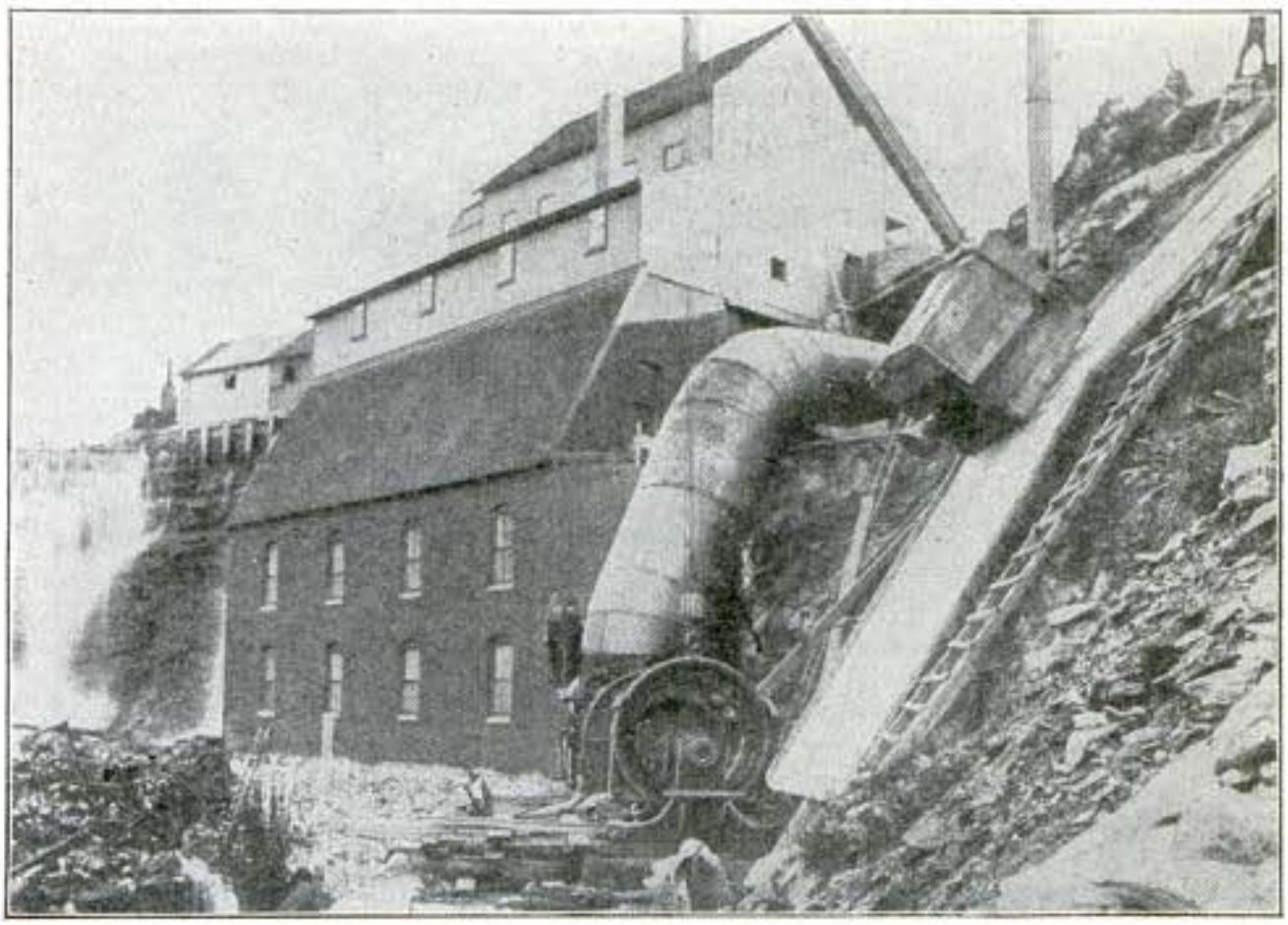
DIFFICULT PIECE OF CONSTRUCTION WORK

How to get into position the immense generators used in some water power plants has been a problem which has taxed the resources of many an expert engineer to the limit. The Electric Journal tells about one of these cases in the state of Maine, where is was found necessary to place the machinery first and then build the power house to contain it, later. The illustration shows the revolving field of a 400-k. w. generator being lowered down the side of a cliff. The single piece weighed five tons, but the work was, in time, accomplished safely and satisfactorily.

PURIFYING DRINKING WATER BY ELECTRICITY

Electricity may in time be used in every home for purifying drinking water. An electric discharge, taking place between two glass tubes, one inside the other, whose surfaces facing each other are coated with metal, develops ozone in the space between the tubes. Ozone kills germs and when some simpler means of developing it has been devised, and a kitchen apparatus which can be connected with the current from electric light wires, has been invented for this purpose, the problem of pure drinking water will have been solved. A Frenchman is said by the Frankforter Umshau, to have invented such an apparatus which works successfully.

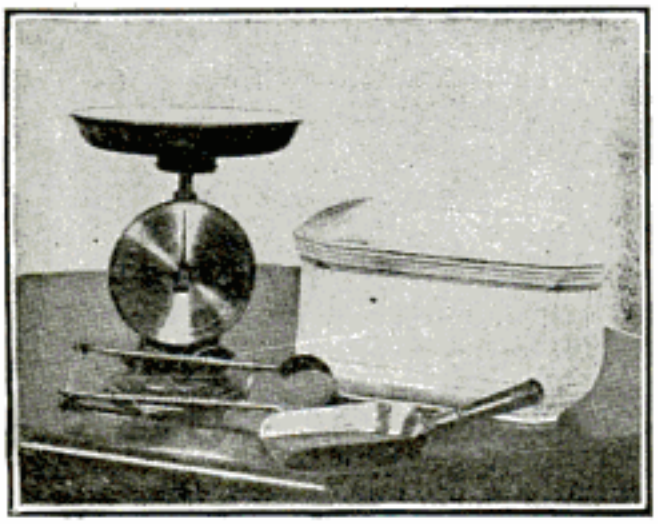
This apparatus consists of a small closed box with a metal cover which is conductory with the bottom. The box contains an ozone developer, an interrupter and a tin tube. The ozone passes through a cotton stopper which frees it of dust and germs contained in the air and then through the tin tube into the water with which it is mixed. The action of the mixer can be interrupted at any moment. The apparatus will purify 60 gal. of water per hour.



Installed Machinery--Then Built Power House

CREMATION GAINING IN FAVOR

Cremation as a means of disposing of human remains is gaining greatly in favor. Our illustration shows the machine by



"The Ashes Weigh 5 Lbs"

which the ashes of a cremated body are weighed and an urn for containing them. The ashes weigh from 5 to 7 lb. and from 75 min. to 100 min. are occupied in the reduction. Recent English instructions in regard to cremation say that coffins to be burned should never be made of English elm, nor of oak; that they must not be painted or varnished, and the only metal that may be used in them is a thin zinc lining. The charge for burning the remains, furnishing a simple urn for the ashes and three months' storage, in England, is but $19.

STANDARD A. M. L. ROAD DANGER SIGNAL

The American Motor League has adopted a standard danger sign as shown in the illustration. The sign is about 2 ft. square.

New Standard Sign

The League will furnish free the stencils for painting the signal, which can be done by anyone in a few minutes.

Objects of India rubber that have become brittle may be replaced in a solution of 1 part of ammonia in 2 parts of water. In half an hour the rubber will resume its pliability and elasticity.—Gummi Zeitung.

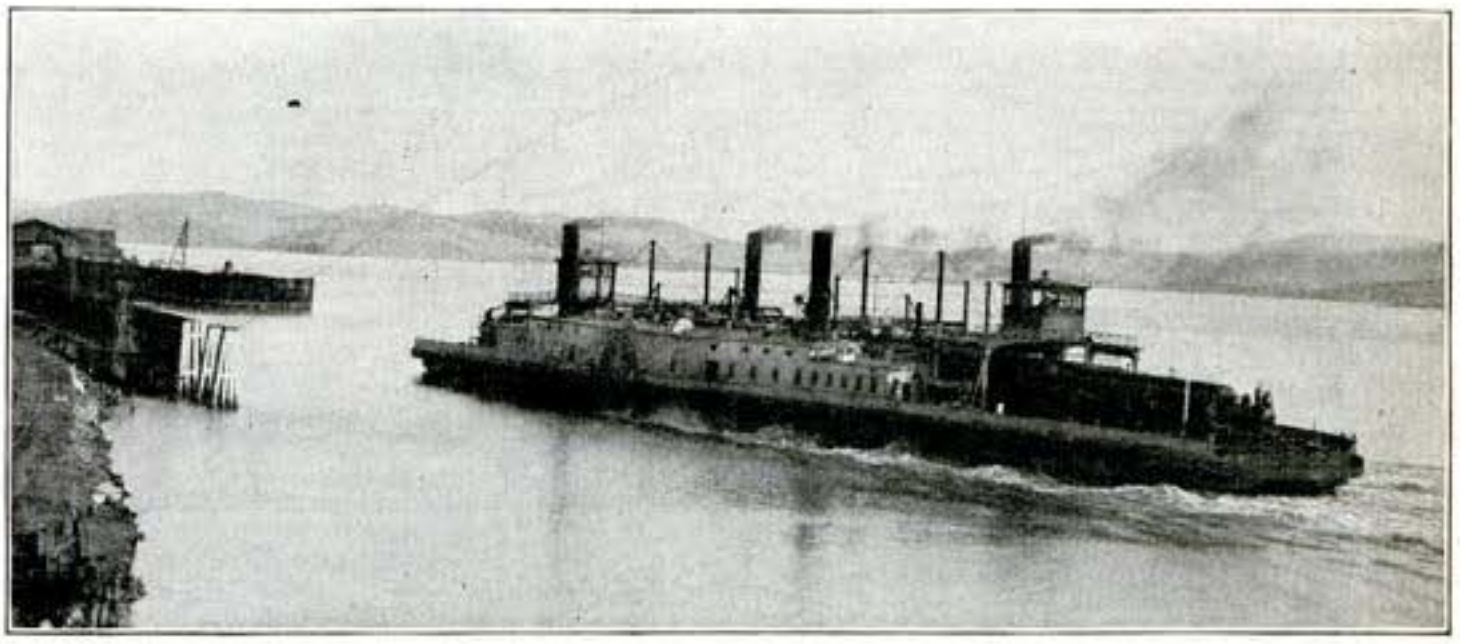
NEW CANOE LEEBOARDS

This device is intended for open paddling canoes on which it is desired at times to carry one sail of an area of 40 to 50 sq. ft., says the Sporting Goods Dealer. A single-blade paddle is used to steer with. The boards are made of cherry, 28 in. long and 11¾ in. wide at the widest part. They will remain in place when either up or down. The upper part, through which the bar passes, is ¾ inch thick and 4 inches wide, and the cleat on the outer side is also ¾ inch. The boards are connected by a round stick 1½ inches in diameter. They are fastened to this stick by brass pins, one in each end, through holes bored between the boards proper and the cleat. To complete the attachment to the boat, the crossbar is laid above the thwart and lashed to it.

Leeboards for Sailing Open Canoes

THE LARGEST FERRY-BOAT IN THE WORLD

The "Solano," the largest ferry-boat in the world, runs on the Sacramento river in California, between Port Costa and Benicia. The train runs onto the "Solano," which has four tracks for her entire length, and the vibration when crossing is so imperceptible that it frequently happens the passengers are unaware of having been near any water, noting only that "the train made a



The "Solano," the Largest Ferry-Boat in the World

Her length is 407 ft.; beam, 65.5 ft.; depth of hold, 17.4 ft.; gross tonnage, 3,549; net, 3,057; nominal h. p., 2,000. Length over all, 425 ft.; beam, outside of guards and paddle wheels, 116 ft. The measurements first given are the register measurements, the length being taken inside the hull from stem to stern. She has projections on both ends conforming in shape to the slips and a separate condensing engine for each of the two paddle wheels. Each engine in turn has two separate sets of boilers, eight in all, measuring 27 ft. 10 in. by 8 ft. 6 in. in diameter. The engine cylinders are 60 in. diameter, 11 ft. stroke. The engine and paddle on each side being separate from those on the other, allows the frequent running of one paddle ahead and the other astern in making a landing. Since being launched in 1879 by the Southern Pacific R. R. at San Francisco, she has never been out of water with but one exception. This was necessitated only three or four years ago, by running on to submerged piles at high tide, in a fog. She is sheathed with very heavy copper, has run continually in almost fresh water, it being only a little brackish, fresher in winter.

All overland passengers whose tickets read to San Francisco, cross at the point where the "Solano" is in service, unless coming by way of Southern California. longer stop than usual a few stations back." The same company that operates the "Solano" runs three modernly equipped ferries between San Francisco and the cities Alameda, Berkeley and Oakland.

WAGON WHEEL HEIGHT STANDARD ADOPTED

An effort has been made for a long time to secure a standard of height for farm wagons. The National Wagon Manufacturers' Association have decided on a standard, which will be furnished the trade as soon as the shops can be adjusted.

The following heights (measured without tire) have been adopted as standard:

Front wheels, 44 inches; rear wheels, 52 inches.

Front wheels, 40 inches; rear wheels, 48 inches.

Front wheels, 40 inches; rear wheels, 44 inches.

Front wheels, 36 inches; rear wheels, 44 inches.

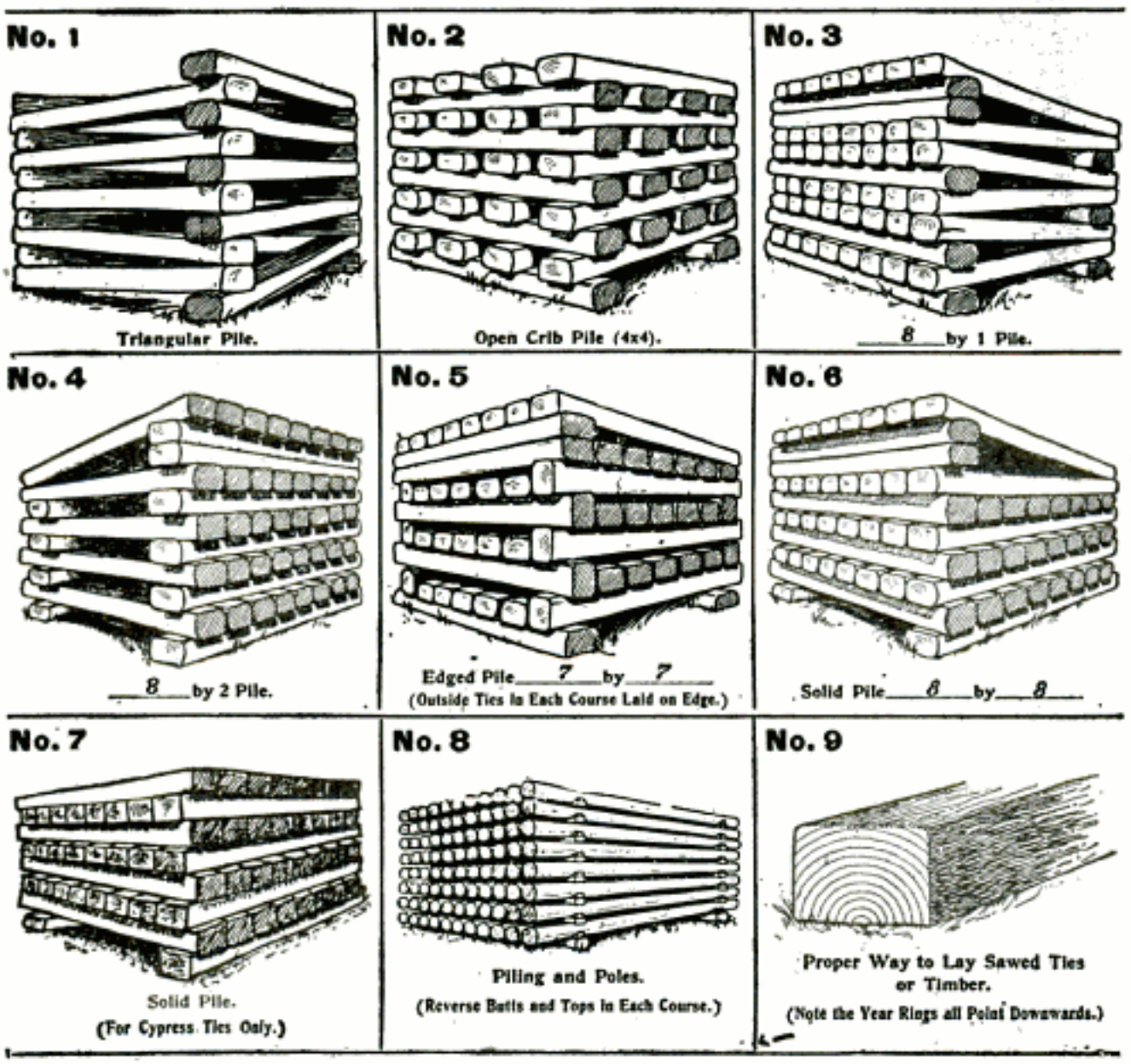
These heights possess every desirable advantage in strength and ease of draft, also the same gears will interchange on three of the heights.

PILING TIES ON THE SANTA FE

Piling railroad ties has been reduced to a science on the Santa Fe railroad. From one end of the road to the other the thousands of piles of ties along the track and at stations are all in accordance with definite rules and for a specific reason. The illustrations from the Railway Review show the seven methods of piling ties, and also one for poles.

Few people would think there was any advantage in laying a tie a certain side up, for instance. Fig. 9 indicates how sawed ties must be placed and the reason is obvious in that when properly laid the grain of the wood sheds rain better than otherwise. It will be noticed that in no instance are more than two ties allowed to touch the ground. Other rules require piles of ties to be placed out of the way of running water during storms, and grass must not be allowed to grow within several feet of the pile, nor must decayed wood of any kind come in contact with the pile.

All these things, while apparently insignificant in the case of a few individual ties, mean the loss or saving of many thousands of dollars in the course of a year.



Scientifically Piled Ties

WHITE MICE ON SUBMARINES

Every British submarine has, as a part of its crew, three white mice which draw a shilling a week pay and are given full naval rations. The mice are placed in a cage near the gasoline tanks and if there is any leakage, their sensitive olfactory nerves detect it at once and they begin squeaking. The crew make great pets of the rodents, and also draw the mice's pay and rations and divide it among themselves.

The Southern California melon crop this year is extremely large. Cold storage warehuses have been built at many shipping points, where the fruits are cooled to about 52° F. before loading into refrigerator cars for shipment.

WIRELESS DID NOT WORK

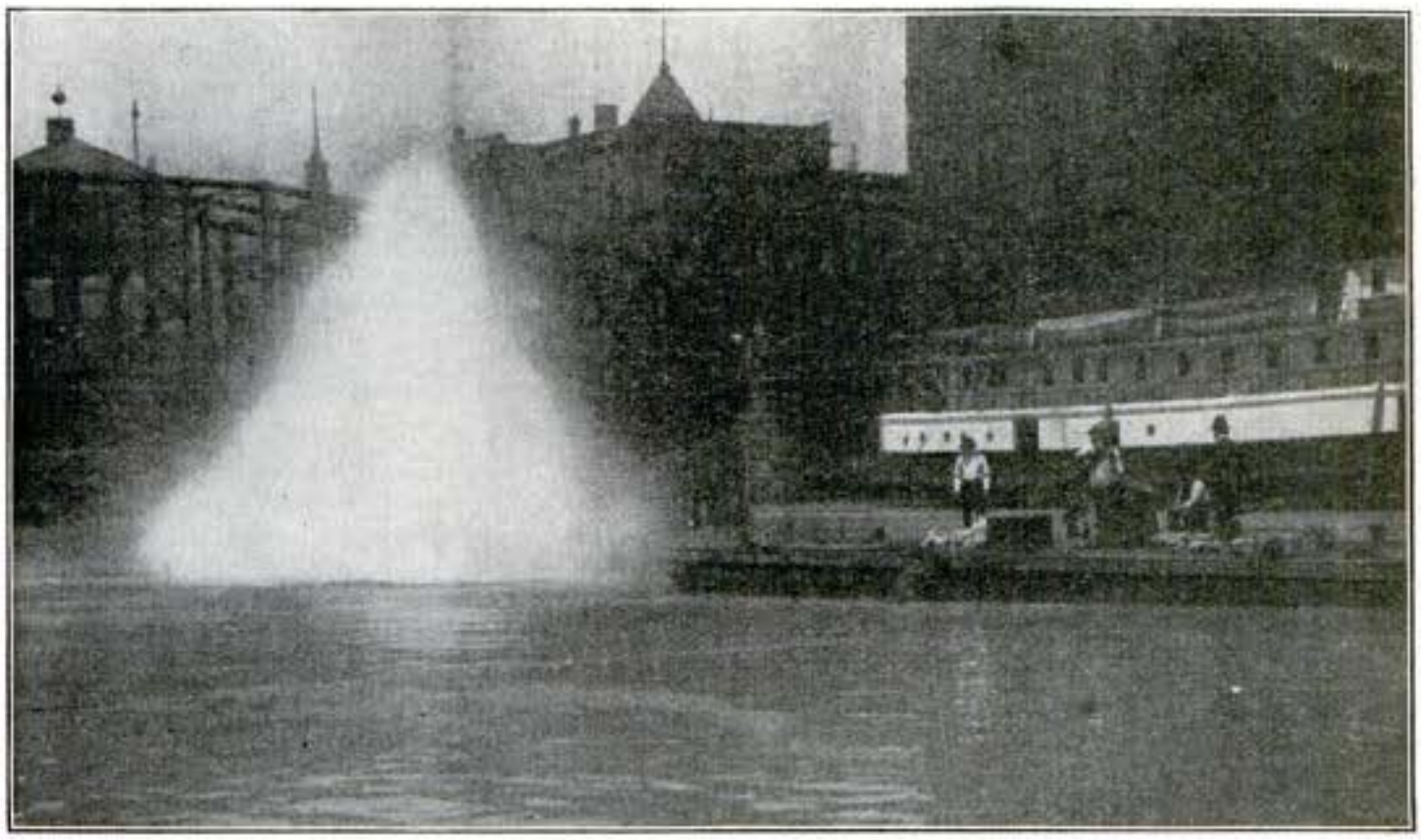
The big Cunarder "Caronia" is equipped with a powerful Marconi wireless apparatus, but when she grounded on Flynn's Knoll recently, she was unable to communicate by this means.

The steamer "Deutschland" when grounded several months ago, experienced the same difficulty. It is suggested that the tall steel buildings on the lower end of Manhattan Island deflected the electric currents. It seems that there still are problems to solve before a perfect manipulation of wireless, under all conditions, is possible.

VESSEL BLOWN UP IN CHICAGO RIVER

Explosion Takes Place in Business District---Thousands Witness Spectacle

An old vessel that after sixty years' service on Lake Michigan sank in the Chicago river and had laid there three years was blown up a few days ago in order to get her out of the way of the large liners that pass up and down the stream. An attempt was made to tow the "Winslow" out into the lake before blowing her up, but when she reached the middle of the river she sank and could not be budged. Divers were sent down to puncture the vessel's sides and she was loaded with dynamite in five different places. The explosion that followed blew her into thousands of fragments, sending the water 50 ft. into the air and affording vast enjoyment to the thousands of spectators who crowded the Dearborn and Clark street bridges. The explosion took place in one of the busiest districts, lined on either side with tall buildings, but apparently did no harm.



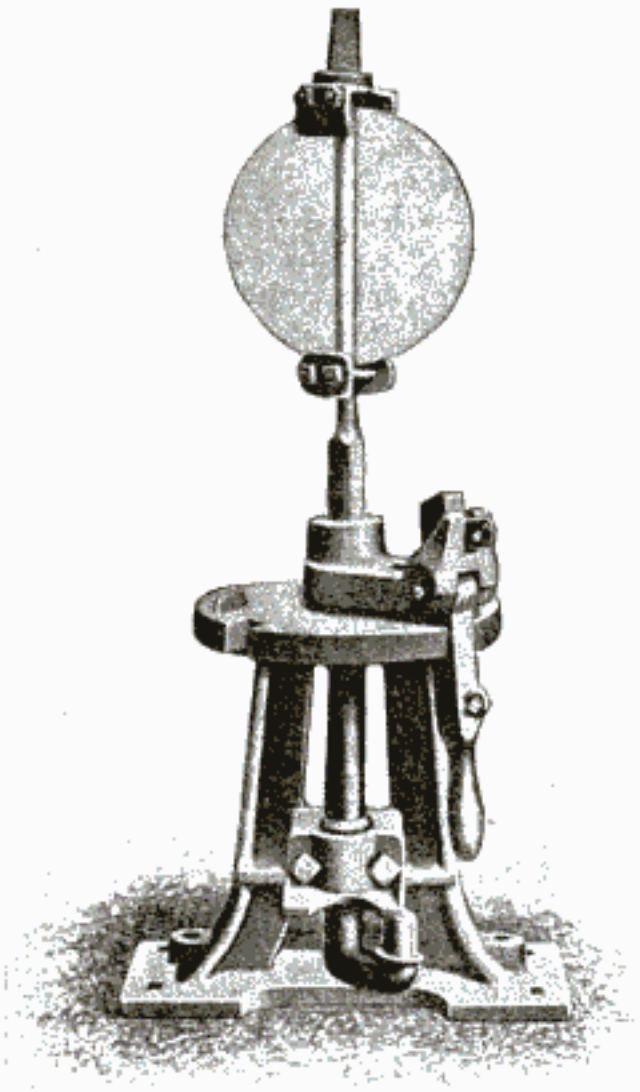
"Water and Wreckage Were Blown 50 Feet into the Air"

RAILWAYS IN JAPAN

Japan already operates 4,500 miles of steam railway, all under government regulation, with 1,344 miles owned and operated by the government. These roads are capitalized for $57,706 and bonded for $10,794 per mile, against an average in the United States of $30,719 of stock and $32,494 of bonds, per mile. The gross earnings per mile in Japan are $12,780 against $9,301 here, while the net earnings per mile are $6,727 in Japan and only $2,887 in this country.

Owing to the cheapness of labor Japanese roads can operate for 47.3 per cent of earnings; the average cost in the United States is 68.96 per cent of earnings.

There were produced in the United States during 1904 a total of 117,065,421 bbl. of crude petroleum, valued at $101,170,466, or an average of 86.4 cents per barrel.



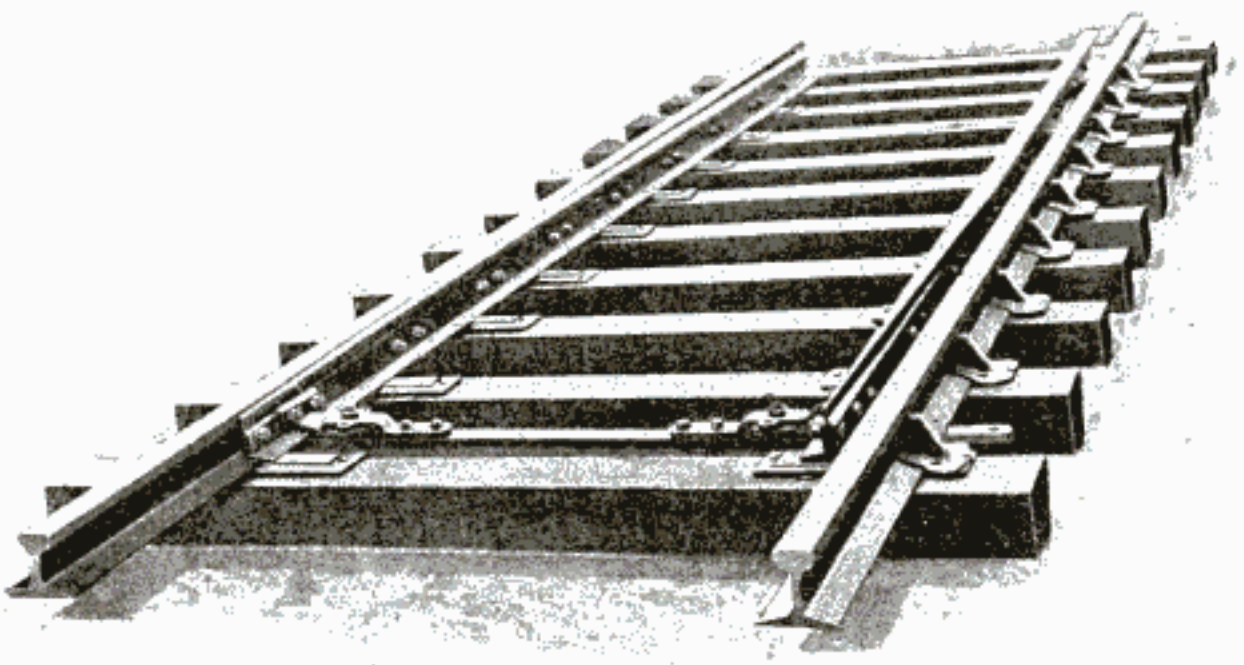
STANDARD MAIN LINE LOW STAND SWITCH STAND: To change the switch it is necessary to raise the handle or lever from its present vertical position to a horizontal position before it can be moved to the left, which action shifts the switch-points. The lever is then pushed down until it occupies the notch shown, when the lever can be locked with a padlock, and the switch-points held firmly.

WRECK OF THE 18-HOUR RACER

Accident Caused by a Switch--Was It Maliciously Thrown--Or Was It "Sprung" by the Wheels of the Locomotive?

Before the 18-hour racers had scarcely been inaugurated the terrible disaster on the Lake Shore concentrated the attention of the public on the undertaking. The Lake Shore route is 56 miles longer between Chicago and New York than the Pennsylvania, but the extra distance is probably fully offset by its easier grades and freedom from curves incident to the mountains of Pennsylvania.

The distance to be covered is 960.6 miles via Lake Shore, requiring an average speed of 53.66 miles per hour; and 904 miles, or an average of 50.9 miles for the Pennsylvania, for an 18-hour run. But out of this must come several stops and time lost on heavy grades, hence the actual running must average practically 60 miles an hour. But 60 miles an hour is nothing new, and is exceeded every day in the year on many roads for short spurts, and not infrequently over an entire division. The 10 per cent in time saved over the 20-hour run would seem to increase the risk in at least some degree: a man walking is less apt to stumble than one running as fast as he can.

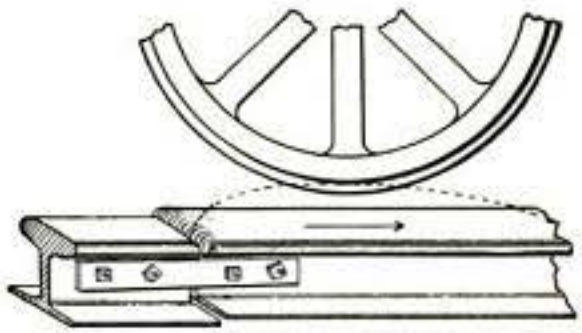


STANDARD SPLIT SWITCH used on high speed main lines On a double track road this would be called a "facing-point" switch if trains moved from left to right of the illustration. It was such a switch that side-tracked the flier and caused the wreck.

Wreck of the Lake Shore Flier, from Photograph taken the morning after the accident. Note position of Locomotive, which has completely turned around.

In its issue previous to the accident the Railway Age said: "Looking at the problem as an operating possibility, the principal question is one of organization, or, perhaps, it should be said, of organization and facilities. * * The possibility is dependent partly upon easy grades and light curvature, but mere upon superior facilities, excellent administration to the minutest details, and esprit du corps. * * The alertness to save seconds that characterizes the operations of these 18-hour fliers puts to shame the sleepy dillydallying at way stations and junction points of the train service generally on most lines * * And it may be remarked that, if an accident shall happen to one of the 'fliers,' it will be charged popularly to the high speed, even if that may have nothing to do with the case."

The real cause of the accident may never be known to the general public. It may be the switch was maliciously turned; it is possible it was left open through carelessness, and not a few operating railroad men incline to the belief that one of the pilot wheels spread the switch. As any one knows who has ever rode in the cab, a locomotive at high speed has two motions in addition to that of advancing. There is the rolling motion from side to side and, at frequent intervals, depending upon the condition of the track, a pitch like a boat at sea. This is caused by passing from a solid road bed to a less yielding one, or by passing over a joint in which the end of one rail is slightly higher than that of the other. This



causes the wheels to follow a parabolic curve, which is shown in an exaggerated degree in the illustration. The flange of the wheel when in good condition is only 1¼

in. deep by ¼ in. thick, and if at the moment of making the "jump" there should also occur the roll or oscillating motion it is easily understood how the wedge-like flange might fail to come down inside the rail, but instead, fall on the top, or head of the rail. If, again, this should happen exactly at the moment of going on to a point switch, it is not difficult to comprehend what would be almost sure to happen.

Some two-track roads are eliminating in every possible case, switches in which the point is toward the oncoming train, and are using only a run-off switch. This, of course, necessitates a train passing the switch and then backing down to take the side track, but it provides a switch that is practically just as safe as main line.

COLORED WOOD FOR FURNITURE

Colored woods are now used for furniture, panels, doors, and for fitting ships and tramcars. In 1901 an Austrian discovered a method of coloring the wood when

New Styles in Colored Chairs

fresh. The tree, having been cut while the sap is in action, is colored by forcing the dye, under heavy pressure, into the wood until it replaces the sap. Lengths of 13 ft. can be colored at one time. Beech, birch alder, maple, elm and basswood take the colors best and the gay colors look best when polished. The amount of waste makes the price comparatively high.

WIRELESS ON MOVING TRAINS

Interesting and successful experiments are being made by the Alton road in sending and receiving wireless messages by the De Forest system from its passenger trains between Chicago and St. Louis.

Signals were very weak while crossing the Merchant's Bridge over the Mississippi river on account of interference of the steel trusses, but where the track runs along the river the signals increased in strength remarkably. Another phenomenon was that better results were obtained when the train was at right angles to the sending station. Several trains will immediately be equipped for communication with stations now located at Chicago, Springfield and St. Louis.

LOCATING FISH BY TELEPHONE

A microphone enclosed in a hermetically sealed steel box, towed overboard and connected with a telephone on a ship, is the device by which a Norwegian proposes to be apprised of the presence of fish and of their number and kind. Herrings or small fish in large numbers make a whistling sound, codfish a howling noise and the microphone is expected to gather and transmit these sounds.

WATER POWER FOR ELECTRIC ENERGY

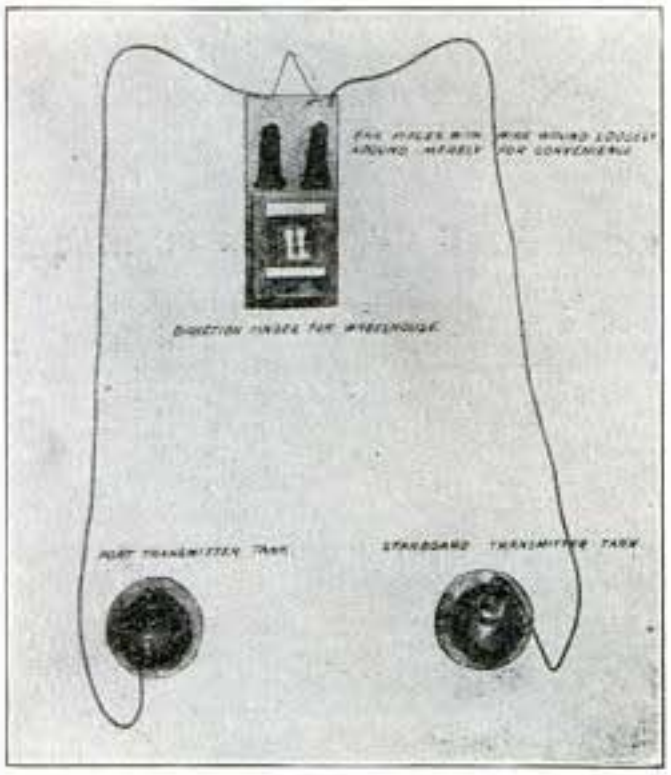
The amount of water power utilized has been estimated to be 1,500,000 horsepower in round numbers. The United States uses the largest amount, mainly on account of the employment of the power of Niagara Falls, which also secures second place to Canada. In round numbers in the United States about 550,000 horsepower of electric energy is derived from water power; in Canada, 250,000; in Italy about 200,000; in France, 160,000; in Switzerland, 135,000; in Germany, 81,000; in Sweden, 71,000, and in other countries lesser amounts. As these statistics are undoubtedly incomplete, the aggregate water power utilized for electric energy in the world is probably 2,000,000 horsepower, which is about twice the steam power used in England and Ireland combined.

SUBMARINE SOUND SIGNALING

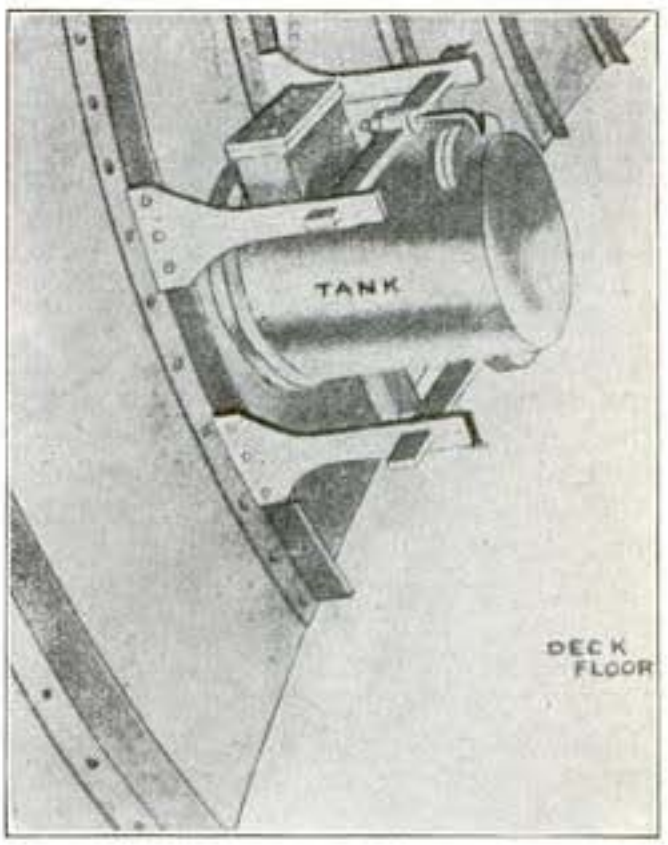
Vessels Warned Against Disaster--Sounds Originating Miles Away Received --May Become Important in Warfare

Water, ever invariable in density, has been found to be the most trustworthy medium for conveying sound signals to ships in danger of going ashore or of colliding with other vessels in a fog. Air signals, experimented with and used for so long, are unreliable, because the density of the air varies, and the price of failure is too great for risk. Sound travels through water without divergence and with four times the velocity that it does in air. The result of this discovery, which was made by Professor Lucien I. Blake, now Professor of Physics in Kansas University, is a system by which a ship can locate a bell-buoy or a vessel many knots distant, the latter by means of the sound made by its screws.

Mr. A. J. Mundy, of Boston, Mass., while experimenting, discovered that if a tumbler filled with a solution were placed inside and against an empty iron kettle floating in a tank of water, the bell sound in the water of the tank could be readily taken out of the solution in the tumbler by means of a microphone immersed in it, says the Shipping World, London. Hitherto the mistake of trying to collect the sounds by towing the apparatus overboard had been made, but the direction of the sounds could not be determined in this way. In the system as it is now perfected and installed on many vessels, two tanks filled with a solution of greater density than sea water are attached to the inside skin of a vessel below the waterline, one being placed at certain fixed points aft and the other at certain fixed points above the keel. A microphone enclosed in a suspended watertight case is wholly immersed in the solution in the tank. One tank transmits the sounds it collects to the receivers in the pilot house, and the microphones of both tanks are connected by wires to the receiver in the wheel house. The bell sound on the port side can be compared with that on the starboard side by merely turning a switch and thus the source of danger can be immediately located. Officers on ships using this system are able to locate a submarine bell within one-eighth of a point.



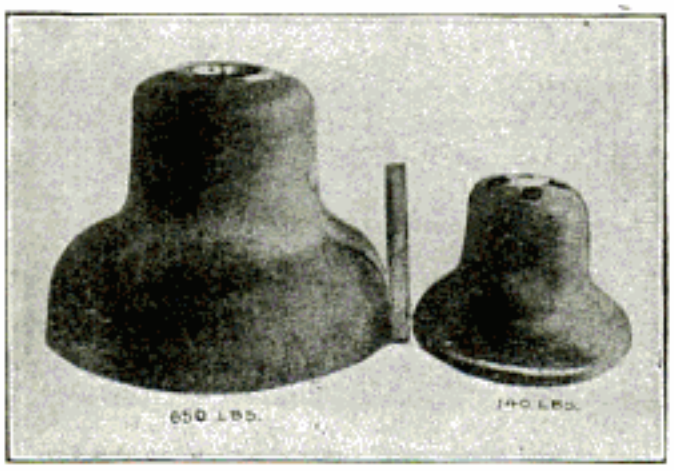
Plan of Signaling System



Tank Enclosing Microphone

The transmitters are adapted to receive sounds of high pitch, as it was determined by experiment in the open ocean that a bell with a lip or "sound bowl" several inches

thick and with a high musical note, gave the best carrying note in the water. A 3,000-lb. bell on the end of a 1,500-ft. cable, 60 ft. from the sea surface, and 50 ft. above the floor of the ocean was kept in operation in an exposed position on the Atlantic coast for one year in these tests. A very small



Type of Bells Used

bell of this kind could be heard 16 knots away. With the arrangement described, the microphones gather submarine bell notes and sounds of steamer screws so that they can be distinguished from other sounds.

Some of the largest and swiftest ocean steamers are equipped with the system; the United States navy has given it great attention. Experiments in locating submarine and torpedo boats by this means were made at Newport. These vessels could be heard for a long distance, and it is possible that the system will become important in resisting submarine attacks in warfare. Two bells on the Nova Scotia coast can be heard at a distance of five miles and the Canadian department of marine has contracted for the installation of the receiving apparatus on thirteen vessels.

JAPANESE TELEGRAPH WITH FIGURES

As the Japanese have no alphabet, every word in their written language being represented by its own character, they have contrived a unique system for use in telegraphy. The government has compiled a dictionary of 10,000 words commonly used and to each word is allotted a figure from one up to 9,999. The telegraph operator assigns the proper figure to each word of a message to be sent and then transmits the figures by the Morse code. At the other end of the line the message is translated by the aid of one of the government dictionaries.

KNOTS USED IN WEAVING

In manufacturing cloth, the yarn is most liable to break when it is being wound from any of its preliminary forms on to warpers' bobbins, says Technics, London. Fig. 1 shows the winder's or spooler's knot which is used to tie the threads in these instances. The knot is shown before tightening. The knots are an important factor in the quality of the cloth and sometimes the winders are paid a higher rate to use the weaver's knot shown at Fig. 2. This knot is very secure and after it is tied the ends are clipped short, making a neater appearance.

Sometimes a mechanical knotter (Fig. 3) is used. This consists of a piece of steel wire, one end of which forms a hook that is sharpened on the inside to form a cutting edge. The wire is bent so as to bring the hooked and straight ends together and is fixed in a handle of wood or has one of white metal moulded upon it. The device

Fig. 1

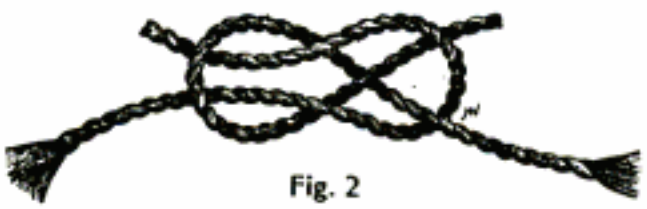


Fig. 2

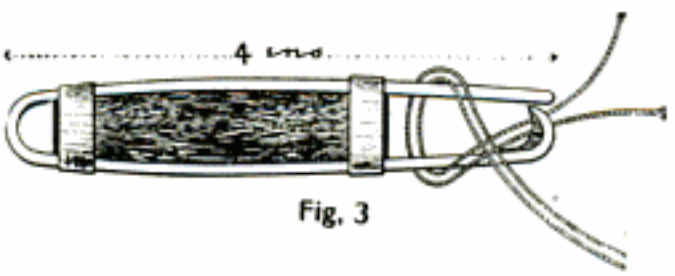


Fig. 3

does not tie the knot and cut off the ends automatically, but is convenient as a hand-tool for the operative and helps him keep the short tail-ends of a uniform length.

A remarkable gas well has been discovered at Yamachiche, Quebec, it is reported. The boring had reached a depth of 230 ft. when a flow of gas, salt water, sand and rocks shot into the air to a height of 200 ft., forcing drill, derricks and trappings out of the well. Work on the well was stopped temporarily.

MOTOR POLICE PATROL WAGON

Police departments are getting the motor fever, and already several patrol wagons are in service which are motor propelled. The illustration shows a wagon which the Motor Age says weighs 4,500 pounds and has a low body with heavy brass railing on either side and a broad rear step, the entrance being from the rear. The operator's seat occupies but a small portion of the vehicle, leaving practically three-quarters of the body accommodation for carrying purposes. All operating devices are closely centered around the operator. In front of him is the inclining steering wheel column, at his right the change speed and emergency brake levers, at his left a 9-in. reflector searchlight with generator and pedals in the footboard. The vehicle accommodates 24 men, 16 in the main body on the side seat, 2 on the front seat beside the driver, 2 on the rear step and 2 on the running board at each side. On the sides are large lockers for carrying such necessaries as stretchers, medicine chest, coats and blankets.

"This Vehicle Accommodates Twenty-Four Men"

Ten miles of the Pittsburg, Bessemer & Lake Erie R. R. will be laid with steel ties in a test of their value in comparison with wooden ties. The road has ordered 2,100 tons of the ties.

Berlin's telephone system has 60,683 subscribers and connections, 15,000 of which are branch connections. It is said to be the largest system in the world.

HOW AUTOS RAISE THE DUST

Largely Due to the Form of Construction of the Car Body

It appears that motor cars abroad are no better behaved in the matter of raising dust, than with us. Here it is simply declared a nuisance; there the cause has been made a scientific study, the results of which are published in the London Engineer, from which we condense the following:

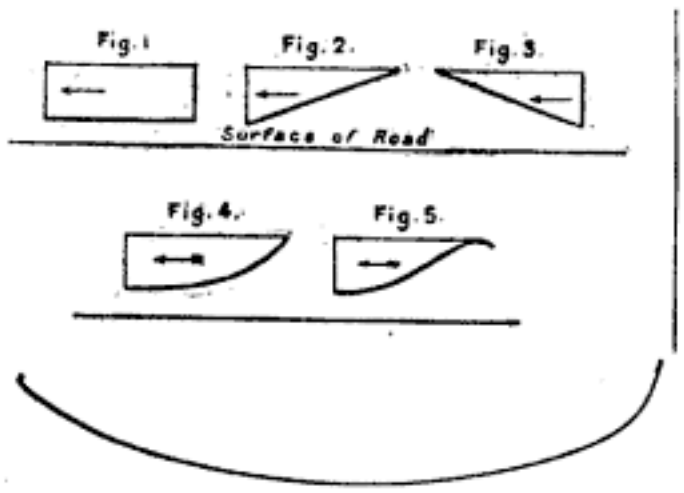
If air were a perfect gas there would be little or no dust. Nothing would remain suspended in the atmosphere that had a greater specific weight than air. Just as a feather and a sovereign fall at the same velocity through a vacuum, so in frictionless air the dust raised from a road would return instantly to the ground. Furthermore it is not clear that any dust could be raised at all. In dealing with the question at issue, we have first to consider the effect of a vehicle on the air, and then the effect of the air on the dust.

Let us suppose that a fan made like a paddle-wheel of a steamer, is caused to revolve high above the surface of a dusty road; no effect will be produced. Let, now, the fan axis be gradually lowered, and it will be seen that as it approaches the road surface it will begin to raise the dust, and the nearer it is to the road the thicker will be the dust cloud. If for the fan we substitute a board supported at each end on wheels running on a gantry over the road, it will be found that the board will

raise the dust in front of it, and that this dust will be dragged after it in a cloud by the eddy action of the air following the moving board. The front of the column of air set in horizontal movement is much larger than the board. Many of our readers have, no doubt, seen Professor Boys' wonderful photographs of a bullet in flight, and will remember that the projectile carries with it a volume of air apparently clinging to it, which passes through the atmosphere and sets some of it in motion at a comparatively slow speed. Every object moving through the atmosphere sets up currents in it—for the most part by induction due to the friction of the molecules on each other, or to what is known, in other words, as the viscosity of the gas. All this may appear very elementary, but it is constantly forgotten; and whether it is or not, the facts seem to be usually disregarded by the designers of motor cars. When they have provided what are known as torpedo heads for racing cars they appear to think that they have done everything.

Many persons suppose that a current of air runs like a river under a car in the direction opposite to that in which it is proceeding; when the car is running, wind is felt "blowing" on the face, and it is taken for granted that it is blowing all round the car. Of course it is doing nothing of the kind, unless the car is proceeding against a head wind. We are assuming, however, that the day is quite calm, and the speed, say, twenty miles an hour; then the subjective or physiological effect is the same as though the motorist stood still and the wind blew. There is in effect no rush of air backwards under the car to raise the dust. In reality there is a rush of air forwards, or in the same direction as that in which the car is moving, and this is, apart from the wheels, the principal dust-raising factor. Let it be kept constantly in mind that if air were visible we should see the motor car accompanied and surrounded by what, for want of a better term, we may call a nebula. The volume and the velocity of the nebula augments with that of the car in some at present unknown ratio. There is reason to believe that once a certain speed is reached, there is no further augmentation in volume. But the fact has no interest for the motor car builder, for the critical speed is never reached on a highway.

The first part of the problem set before the builder is to ascertain what form the vehicle should have that will give the minimum volume and velocity to the body of air traveling with it. Probably a parabolic cylinder of some kind would be the best; but no good purpose will be served by basing deductions on the performance of forms which cannot be given to motor cars. Again, it is not clear that the upper portion of a car has any great effect, for the same reason that the rotating fan mentioned above will not much disturb dust while some feet over it. It is the lower part of the car—the chassis, in fact—on which attention may be concentrated with most profit; and so far it may be taken as proved that the higher the bottom of the car is above the road, and the smoother the surface, the less will be the dust-raising power of the car. Several months ago the Automobile Club undertook and carried out a series of interesting experiments on a specially prepared track at the Crystal Palace. Stive or mill dust was laid down on a track, and cars of various forms were run over this track at various speeds, and the result photographed. The broad conclusion was that cars with flat, smooth bottoms nearer to the ground at the front than at the back raised very little dust. The placing of a flat leather sheet under a chassis converted a very bad car into a very good one as far as dust was concerned. The Crystal Palace experiments went to show that a casing further from the ground at the back than the front gives



the best results. Figs. 1, 2, and 3 show three forms of casing under a car moving in the direction of the arrow. Fig. 2 is the best and Fig. 3 the worst. It is not, however, impossible that still better results would be obtained by making the lower surface in Fig. 2 curved as in Fig. 4, as being less likely to maintain the "drag" on the air which does the mischief.

THE GAS ENGINE AND NAVIGATION

Engines Up to One Thousand Horsepower Now Practical in Marine Service---Greater Speed Gained---Economy of Space---Small Expense ---High Efficiency Attained

The use of the gas engine in navigation has, within the present year, become so promising that several prominent authorities, among them Dr. Alfred Gradenwitz of Berlin, predicts that in time river traffic, with all its old life and bustle, will be resumed. That the river towns that fell into an hundred years' sleep when the steam railways began to thread the continent, will reawaken and be claimed by the powerful Prince of Commerce and that the waterways will become the formidable competitors of the railways.

This significant promise has sprung to life by an efficient adaptation of the gas engine and producer to the peculiar requirements of marine service, made by Herr Emil Capitaine, of Frankfort, Germany. The result is a plant fitted in every way to compete with the marine steam engine up to outputs of 1,000 brake horsepower, or, in case of twin screw, 2,000 electric horsepower, at a cost of about 2 cents per running hour for a 10-hp. plant.

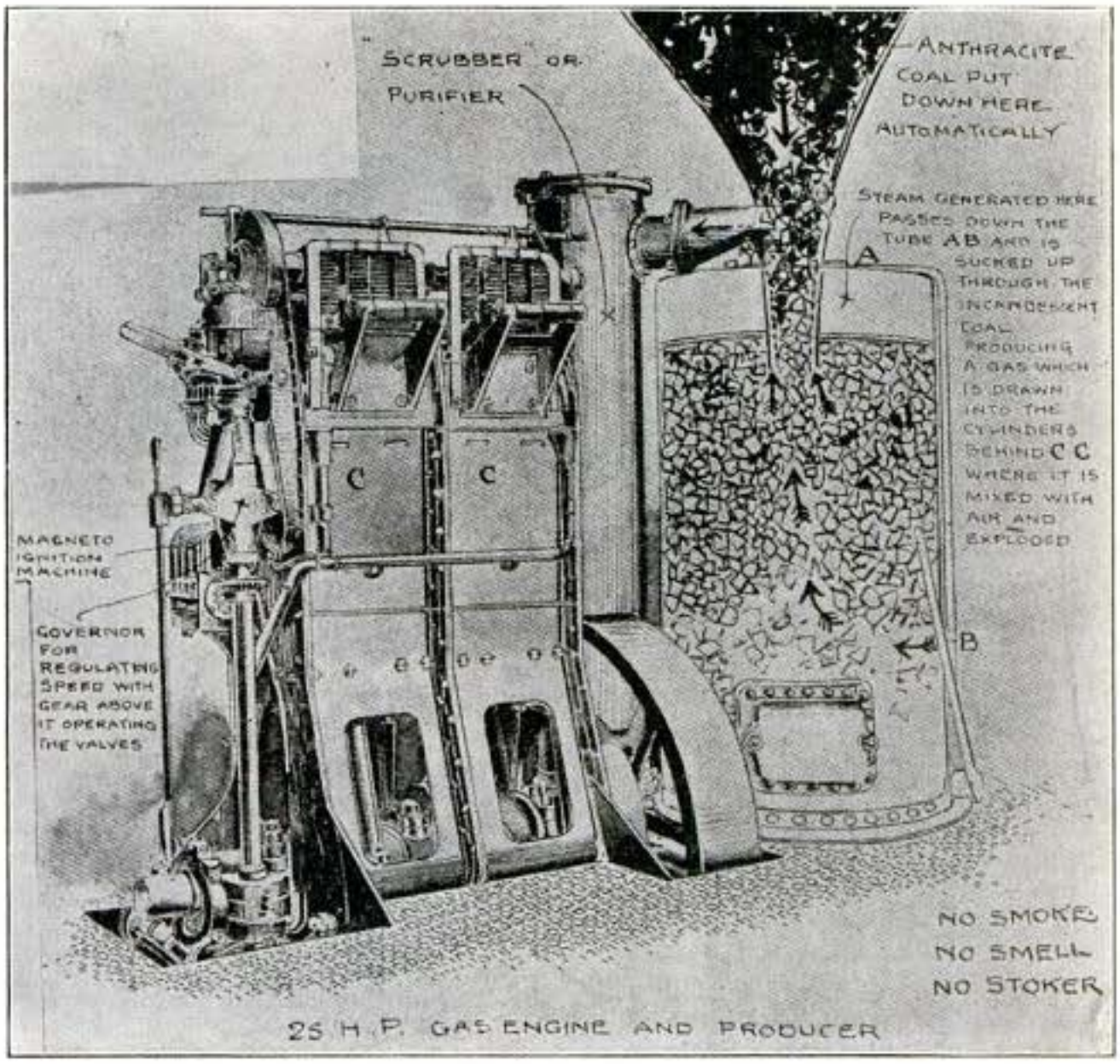


Fig. 1. Herr Emil Capitaine's Plant

Of Herr Capitaine's plant the producer gas installation is most important. This consists of a large drum (Fig. 1) lined with firebrick to a depth of four feet. In the space above this drum is a water reservoir. Coal is fed in at the top of the drum, automatically, until the space within is entirely filled. The fire is then started

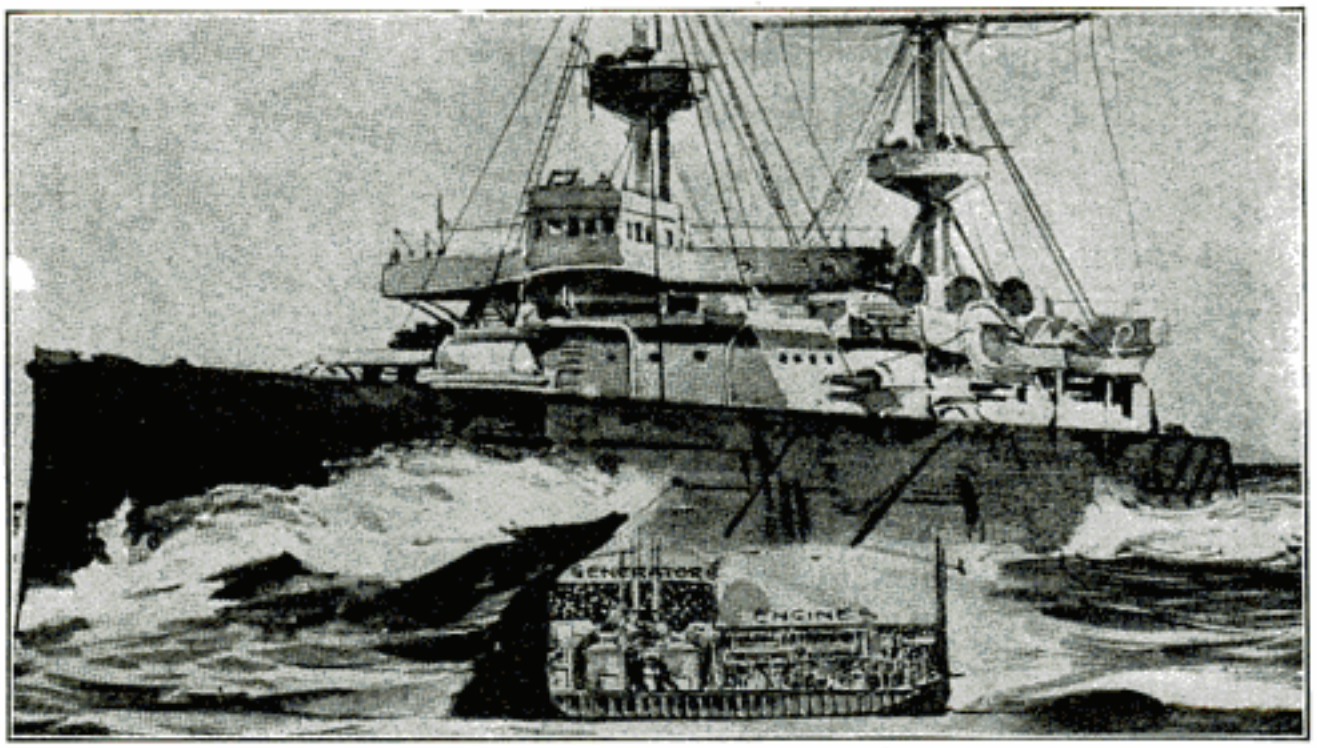


Fig. 2. Proposed Gas Engine Installation for Warships

and steam raised in the reservoir, passes down tube A B, Fig. 1, and is directed on to the grate by means of a blowpipe; simultaneously a current of air is injected. The steam and air strike a ring of incandescent coal that has formed around the edge of the dished plate that forms the grate. This plate is a little below the brick-lined drum, and its height is regulated by a rack and pinion worked by a lever mounted on a quadrant. The gas thus formed is of such high temperature that it is necessary for it to pass through a cooler and then a scrubber to clean it of any foreign particles before passing on to the motor for use as fuel. The cooler through which the gas passes consists of a drum of small diameter, at the top of which the gas passes round a flat cooling coil through which a spray of water is passed.

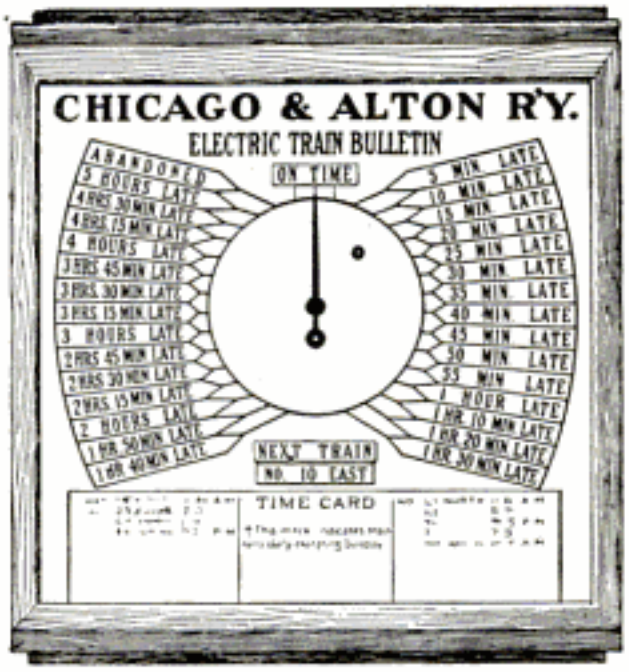
The gas is purified by a jet of water and then, clean and cooled, passes through baffles at the bottom of the drum and is conveyed to a centrifugal drier and is then ready for use in the motor.

The body of the motor used in Herr Capitaine's plant is of sheet iron, in order to obtain the minimum weight with maximum strength. A two-cycle 30-hp. engine and gas generator of this type occupies a space 7½ ft. long by 3½ ft. wide by 3½ ft. high and weighs two and three-fourths tons. The cylinders are 8.27 in. in diameter, stroke 11.02 in., normal speed 200 r. p. m. The motor is started by compressed air. A four-cycle, 600 hp. plant is being installed on a large commercial craft for demonstration purposes. Herr Capitaine has a launch equipped with one of these engines, also.

It is said to be improbable that a higher efficiency than 16 per cent will ever be obtained with marine steam engines (reciprocating or turbines). The very bulk of the coal necessarily carried in steam navigation imposes large dimensions in vessels. The radius of action of a warship would be doubled in value if only one-half the amount of coal usually carried would suffice, declares Dr. Gradenwitz. A perfect utilization of fuel is hardly to be overestimated. The small quantity of fuel required for the gas producer and the high efficiency obtained brings the new gas plant the nearest to the ideal for the conditions of anything yet tried. And, although Herr Capitaine's plant is adapted only to vessels requiring up to 1,000 hp. because of greater stroke and larger reciprocating masses, such as piston and connecting rods, required, the foundation is laid and the question now lies only in adapting these parts to work in less space. Anthracite coal must be used for the gas engine, it is true, but the amount required is so small, that the operating expense is materially less than in a steam engine of equivalent horsepower; the speed it is possible to attain with the gas engine is considerably higher and in its present development the plant is admirably adapted to the requirements of tugs, barges and large sailing vessels, meaning a saving in millions of dollars of coal.

ELECTRIC TRAIN BULLETINS

An ingenious electric train bulletin has been installed by the Chicago & Alton Railway Co. in a number of its stations and



in some of the principal hotels in cities and towns through which its trains run. The device resembles a clock in appearance, a hand moves on a dial and indicates whether the train is on time, or if not, how many hours or minutes it is late. All these bulletins in one town act simultaneously and indicate the same fact. The operator at the station controls them all, using a device similar to a telegraph instrument controlled by a telegraph key.

NEW TYPE FREIGHT CAR WHEEL

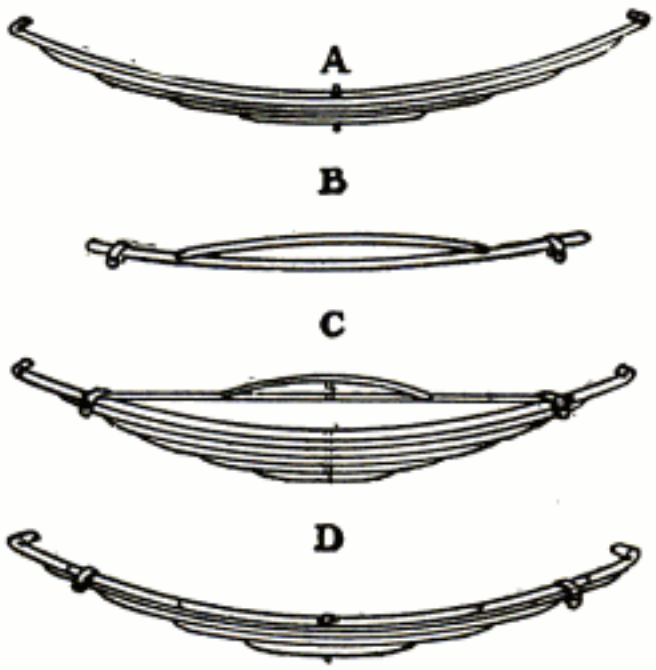
This wheel is called the "Bracket Arch" car wheel, uses a single web which extends inward just back of the flange, and crossing outward meets the hub at the outward end. There are numerous reinforcing ribs extending from the hub and from the tread to this web. There is a large amount of metal massed just back of the flange and the throat of the wheel, which it is said will permit a much more rapid dissipation of the heat caused by the friction of the brake shoes, and also tends to largely increase the strength of the flange, a point in which there is evidently need of improvement. Another feature of this design is that by the use of a single web it is possible to inspect the wheel more thoroughly at the hub than is possible with the usual double web.

"Bracket Arch" Car Wheel

The Railway Review says: "A wheel of this design takes but half the time and pouring that a double-plate wheel requires, which presents the possibility of a much better chill."

AUTO SPRING TO REDUCE SHOCK

A French concern has brought out a new spring which is said to greatly reduce the shock produced by a heavy automobile passing over an obstacle or along rough roads. The Motor News says the device consists of a short two-leaf spring of peculiar form clipped to the concave side of the regular semi-elliptic spring so that the auxiliary spring exerts its effort in a direction opposite to that of the main spring, thus checking the upward thrust of the latter after sudden and violent compression occurs.



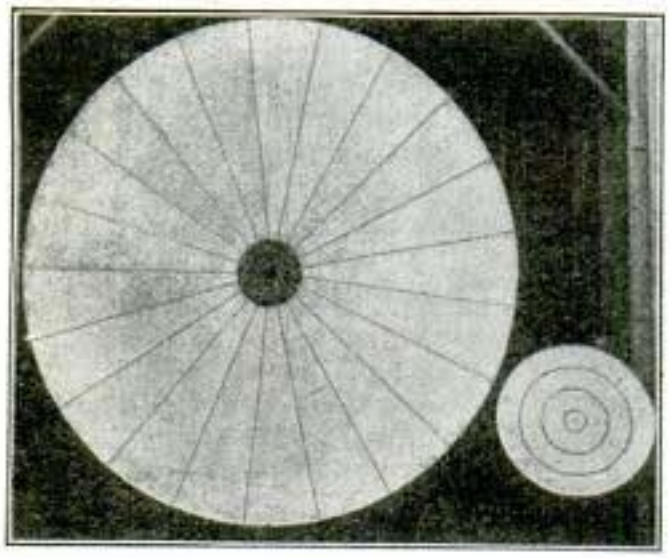
FRENCH SUPPLEMENTAL SPRING LEAF.

A, Main spring without damper spring. B, Damper spring alone. C, Damper spring fitted to main spring but not drawn down. D. Damper spring drawn into place on main spring.

THREE HUNDRED SUN POWER

Medical Apparatus Which Concentrates the Sun's Rays Without Producing Heat

The virtue of pure, unadulterated sunlight is as old as the first place upon which the sun ever shone, and medical experts in these days are using various light treatments for numerous ailments with constantly increasing success. Dr. J. W. Kime, in the Journal of the American Medical Association, gives an interesting description of his latest apparatus for concentrating a large area of sunlight upon a small field, but without burning. The doctor says:



Mirrors for Concentrating Light

During the past six years in which I have made use of light in the treatment of tuberculosis in its various forms, I have constantly felt the need of a much more intense light than any that has yet been produced.

I believe that it is impossible to obtain a light from any source, except the sun, that is sufficiently powerful to accomplish what we desire in this direction. The electric arc light is exceedingly limited, but, with the sun as our source of supply, the amount of light is unlimited, and that which we may utilize depends wholly on the size and construction of the apparatus used to gather up the light.

The illustration shows the mirror which I now use and the relative proportion of one now nearing completion. The smaller is three feet in diameter and contains an area of seven square feet, while the larger has a diameter of ten feet and contains an area of 78 square feet. It is so constructed that all the light falling on the entire surface is concentrated on an area of one-fourth of one square foot. In this manner, sunlight is piled up to an intensity 300 times that of ordinary sunshine.

Such a light would ordinarily be accompanied by heat of corresponding intensity. Provision has here been made for the absorption of this heat, leaving the light in its full strength by passing the concentrated sunlight through 12 ins. of cold water which is flowing through a cooling tank with plate-glass sides.

AUTO DRAWS HORSE

In the earlier days of automobiles it was no unusual sight to see an auto come limping back home drawn by a team of horses. The Automobile tells of a recent incident in Ohio where a farmer had a horse die while drawing his wagon to market. The farmer, desiring to take the dead horse home, had with help from sympathetic bystanders, loaded the animal into the wagon, just as an auto came along. The owner, amused at the unusual occurrence, offered to give the farmer a tow home, which was accepted.

The Horseless Carriage Taking the Horse Home

THE STRINGER TYPE COMPOSING AND CASTING MACHINE

An English inventor named Gilbert-Stringer is putting on the market a machine quite similar to the present linotype, but which casts each letter separately. The principal advantage over the full line slug is that in corrections only one letter has to be inserted, and the time occupied in making an entire slug is saved. The improvement can be adapted to the linotype or monotype machines.

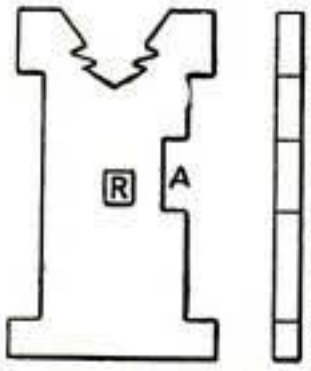


Fig. 1. Matrix

The same keyboard is used for bringing down the matrices which are assembled loosely in the composing box. The die is made on one side of the matrix instead of in the edge as with the linotype machine. The thickness of the body of the type to be cast is determined by a notch which is shown at A in Fig. 1. Spacing and justification is accomplished by means of wedges. After justification the complete line of matrices and wedges are moved to the left where the matrices one at a time are advanced to the mould. In Fig. 2 sev-

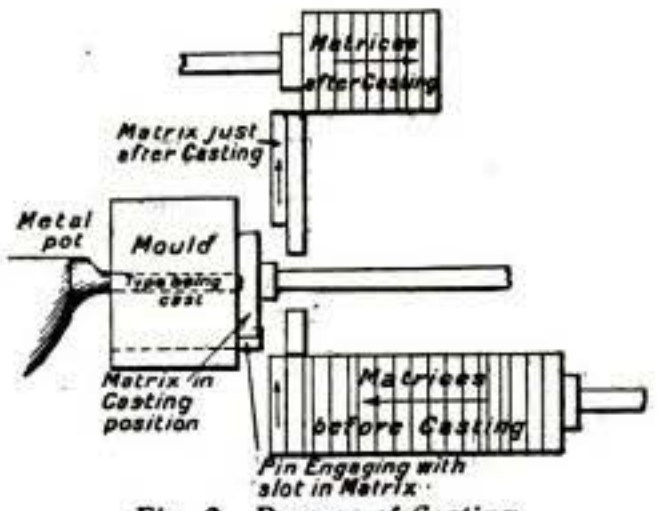
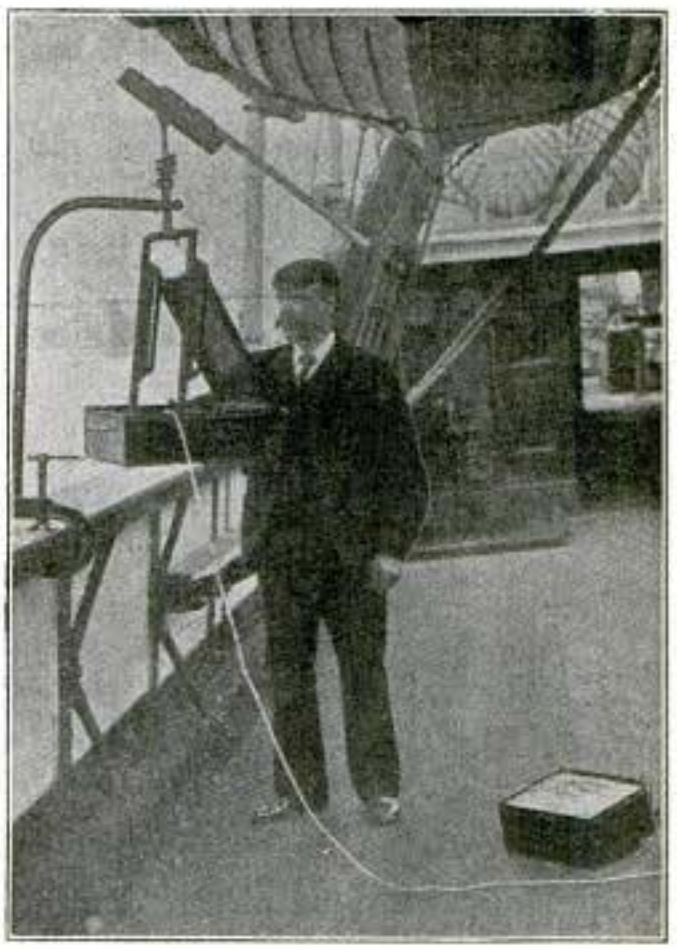


Fig. 2. Process of Casting

eral matrices have passed the mould, one matrix is in casting position and the remainder of the line are ready to come forward one at a time. As fast as cast each type letter is laid in its place in the line in the same order as the matrices were assembled, and the completed line automatically transferred to a galley. As high as 12,000 types have been cast in one hour but 6,000 to 7,000 is a good working average. The mould is water cooled and can be touched by the hand without discomfort, at any time.

IMPROVED ROCKET LIFE LINE

An English inventor gave an exhibition last month to naval officers of an improved rocket-firing gear. By this device the rocket can be accurately aimed, and although a short stick is used, the demon-



Can Be Accurately Aimed

stration showed some remarkable shots. The line is laid in a metal box and so "flaked" that it cannot foul or kink. It is proposed to have the rocket-firing device carried on all vessels, as frequently when a wreck occurs with the wind off shore the life saving crew have great difficulty in shooting a line out to the wreck. The illustration is from the Shipping World, London.

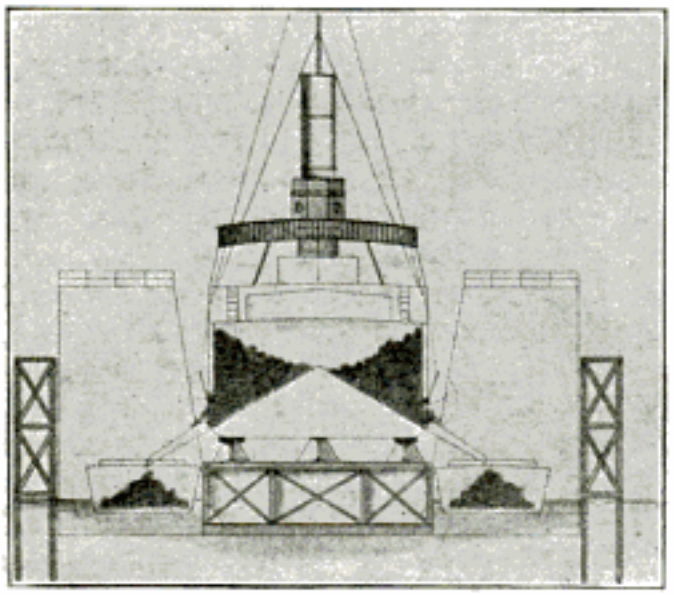
USE OF CONNING TOWERS ON WARSHIPS DOOMED

The use of the conning tower as the center of control on United States warships will probably be discontinued. The Japs have rendered Russian vessels unmanageable by concentrating a heavy fire on the conning towers. An armor-protected space lower in the ship's structure may be substituted. The change will not only be made in new battleships to be built, but ships now in commission will be altered in this respect.

CARGOES UNLOAD THEMSELVES

System Involves Lifting Vessel Out of Water Bodily ---Cheap and Speedy

A London firm has something new in systems for unloading bulk cargoes from vessels. The firm proposes lifting the vessel bodily out of the water on to a pontoon by electrically driven pumps, then through

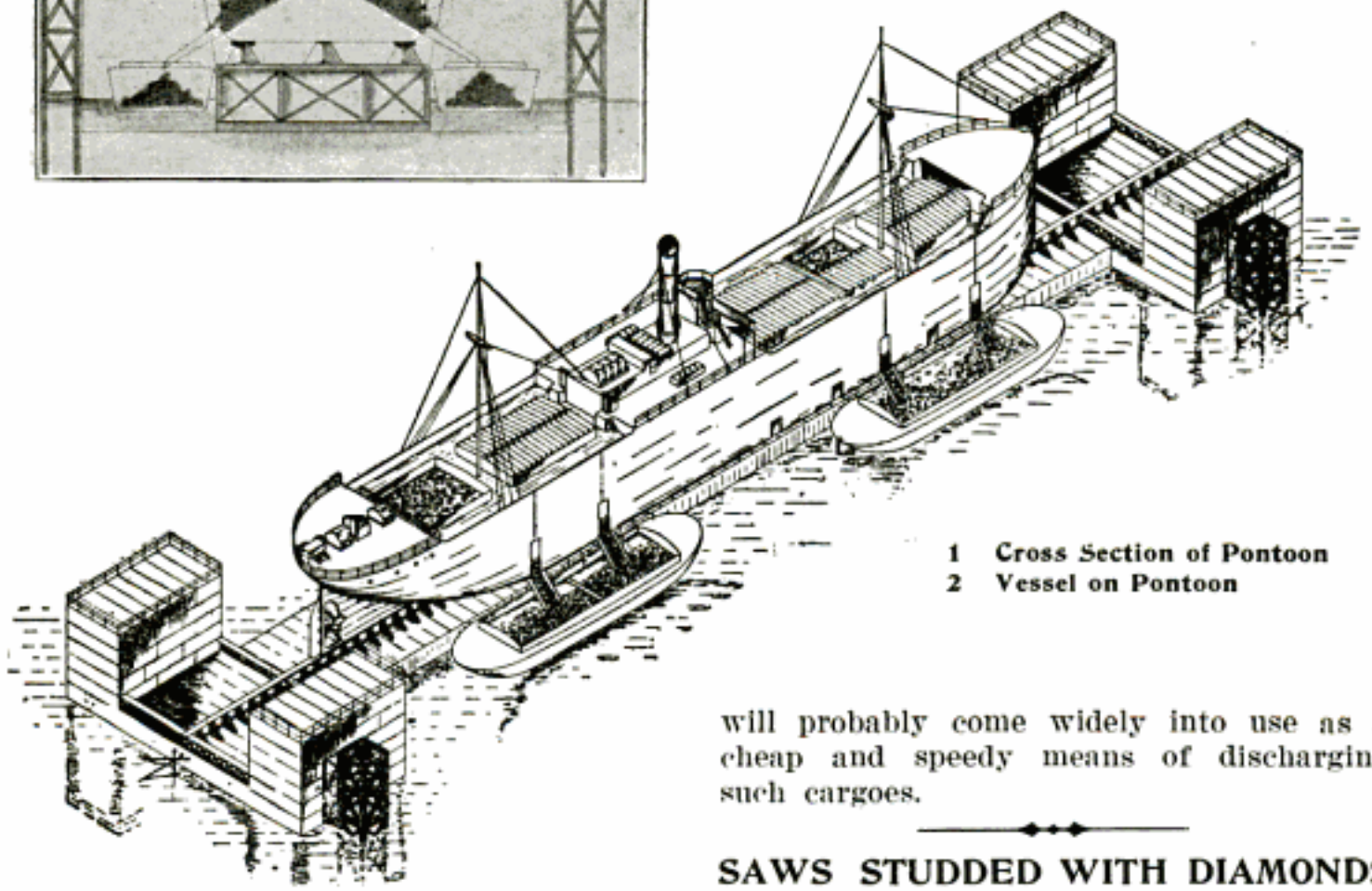


openings in the sides of the vessel allowing the coal or ore to spout out by gravitation into barges drawn up alongside. The lifting of the vessel, it is said, could be accomplished at little expense.

The system involves the use of cargo vessels of special design, having ballast tanks that slope downwards from the center of the hold, so that the cargo can fall by gravitation through the doors in the side, which are double to insure the safety of the vessel should one door become damaged by contact with some submerged substance.

The body of the pontoon is of the width of the vessel to be discharged so that barges can lie close alongside, says the Shipping World. Arms at both ends and towers hold the vessel and pontoon stable during the whole process.

The great advantages of this system are said to be lessened cost of discharging the cargo and an important decrease in the time occupied. On the other hand, its one great disadvantage lies in the fact that there is no means of weighing the material discharged without taking up too much time. This is a serious drawback where the cargo is grain, but, as at many ports, ore and coal cargoes are not weighed, the intake weight, less one or two per cent being satisfactory to consignees, the system



1 Cross Section of Pontoon
2 Vessel on Pontoon

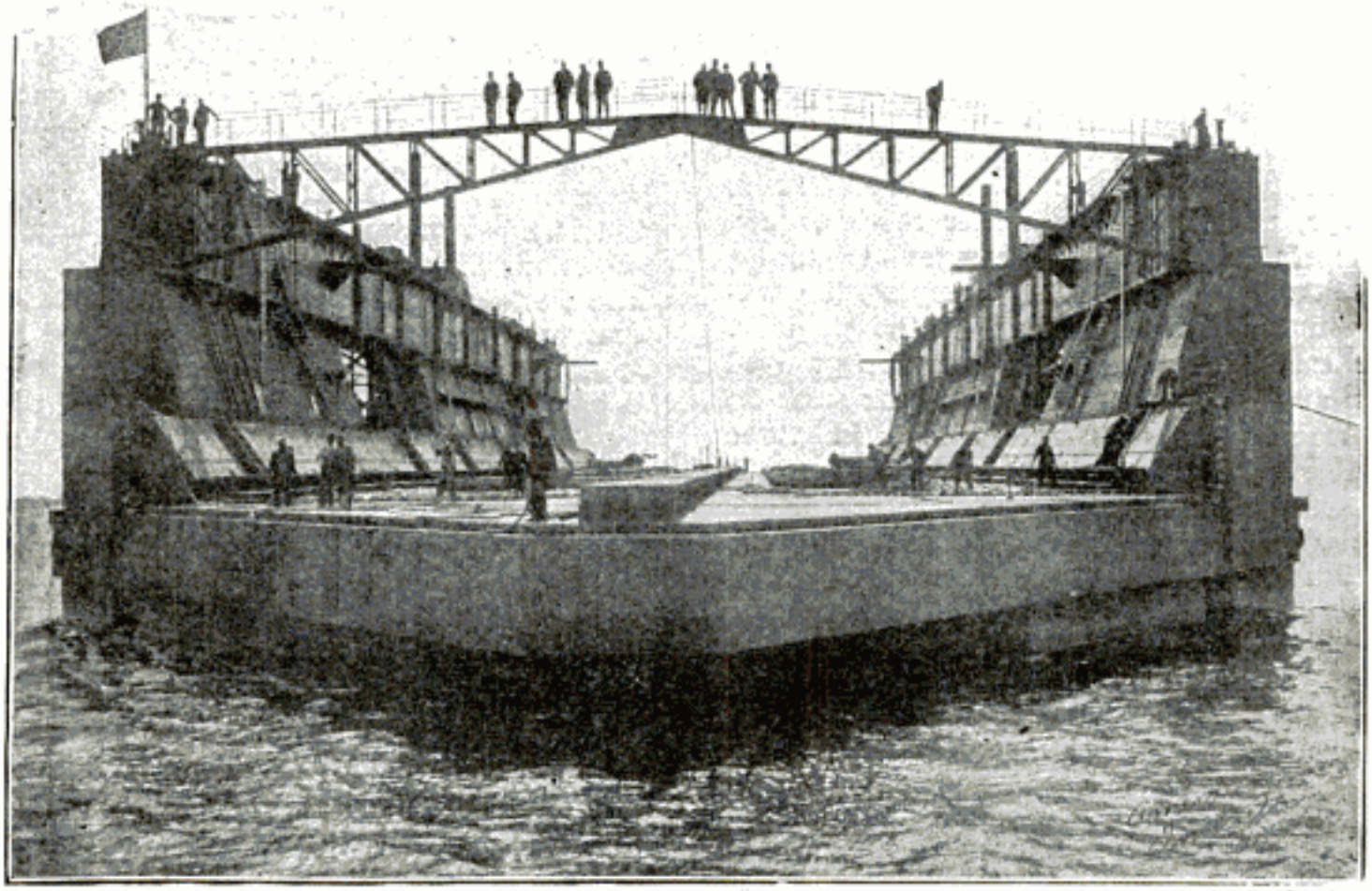
will probably come widely into use as a cheap and speedy means of discharging such cargoes.

SAWS STUDDED WITH DIAMONDS

One of the saw manufacturers is turning out on a special order several saws which will cost $1,000 each. These saws, which are circular, are for sawing stone, and instead of the usual teeth they are each fitted with 150 sockets into which is fastened a special blank or tooth which projects ⅛ in. over the edge of the blade. In each tooth is fitted a black diamond. These diamonds are from the South African mines and cost $6 each. The saws are from 60 to 75 in. diameter.

LARGEST FLOATING DOCK EVER BUILT

Lifting Power 20,000 Tons--To be Towed from Baltimore, Md., to Cavite, Philippine Islands--Distance 14,000 Miles



Courtesy of the American Inventor

The Cavite Dock. Now on its 14.000-Mile Voyage to the Philippines

The largest floating dry dock in the world, built by the government for use in the Philippine Islands, was recently floated and christened "Dewey" at Sparrow's Point, Md., and on June 9 the huge structure left Chesapeake Bay on its 14,000-mile voyage around Cape Horn and across the Pacific to Cavite, P. I. The journey will occupy at least three months, as the cumbersome dock can only be towed very slowly.

The dock is a complete navy yard which may be used for repairing a vessel when a thousand miles from land just as well as when it is located in a harbor. It is equipped with a machine shop fitted up for making all ordinary repairs, has an electric light plant and a water distilling apparatus capable of converting 2,500 gal. of salt water into fresh water for the boilers, daily. It also has permanent quarters for nine officers and twelve men. In construction it is made up of three sections, each complete in itself. The two end sections are arranged to slide under the center section when it is being docked. The bottom of the dock is an enormous steel tank made of 1½-in. plates, divided into watertight compartments by transverse bulkheads strengthened by longitudinal frames. These compartments may be filled from openings in the hull, and the pumps that empty the compartments are located in the walls of the dock, where also are the quarters for officers and crew, the machine shop, the distilling apparatus and the electric light plant. The end docks may be used for tugs, torpedo boats and other small craft.

The Cavite dock is 525 ft. long, 134 ft. wide outside, and 100 ft. wide between its walls, which is the space allowed for docking large vessels. When floating at its lightest the dock draws 6½ ft. and when submerged 30 ft. it requires a depth of 63 ft. The height of its side walls is 63½ ft. and the average depth of the pontoons is 18½ ft. Above all, it can lift 20,000 tons weight. It is estimated that fully equipped, its displacement, when submerged to the level of the pontoon deck will be 35,129 tons.

Suppose a 16,000-ton battleship is to be docked for repairs: First, the pontoon is

sunk by letting in water until the pontoon deck is far enough submerged to give a foot of water between it and the ship's keel. The vessel floats on to the dock without striking, being carefully guided between the walls. Finally her speed is checked, engines reversed and she comes to a full stop. Big cables are run from the vessel to the stanchions of the dock.

So far, the dock has done no lifting—has evidenced no particular power—now comes the supreme moment: The three 24-in. pumps, used with the center section, each connected to a 225-hp. compound engine, are started up and begin pumping the water in great columns out of the pontoon. Air takes the place of the water pumped out, and so, foot by foot, the dock with its enormous burden is raised and in three and one-half hours, according to specifications, this part of the work is completed. When the repairs have been made, the valves in the pontoon are again opened, the structure submerged to the proper depth and the vessel floats out.

The quarters for the men are comfortably fitted up with all conveniences, even to marble bath tubs and shower baths. Revolving fans keep the air in the walls of the dock cool, for it will be in service in the tropics.

The repair shop contains tools and machines operated by compressed air, a swinging crane, and many modern devices, and is run by its own engine.

The dock is entirely the work of American engineers and 300 men have been engaged constantly in its construction, which required 11,000 tons of steel and 2,000,000 rivets. In painting it, 130 tons of red lead and linseed oil were used. The total cost approximated $1,200,000. The great advantage of having such a powerful dock at our new possessions is obvious.

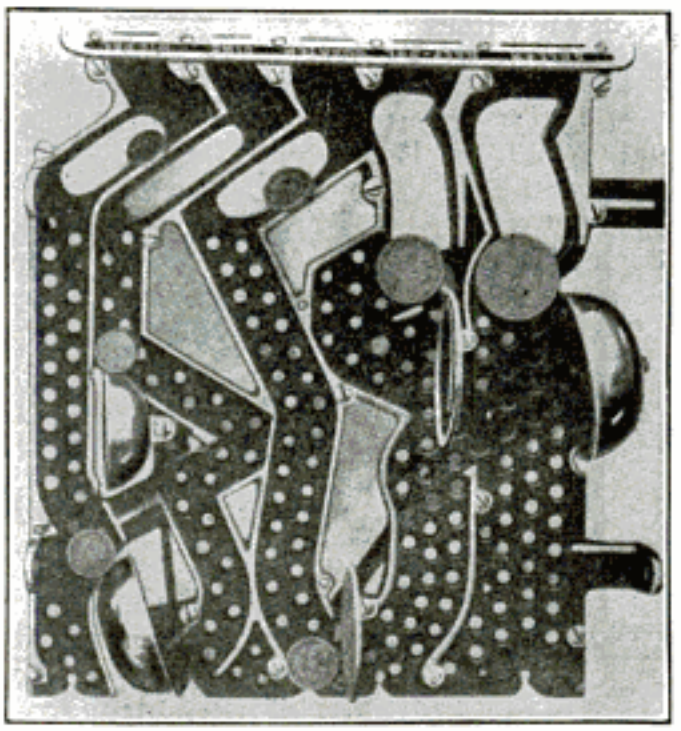
WHY STEEL FENCES RUST

Cinders, salt, coal, coal smoke and fumes from manure piles will rust steel fencing when it is piled where it can be acted upon by the acids from any of these things, says the American Fence Bulletin, and adds that what may be generally charged to deteriorated quality of steel today can be plausibly explained away in increased corrosive conditions of the country atmosphere. In the olden times wood, for nearly every purpose, was the fuel used; locomotives were few, and the rich soil did not require manuring. Now plants and little industries crop out at all points, traction engines travel the country roads, many huge locomotives rush through the farmlands, and the soil must be enriched by artificial means. Soft coal is the fuel extensively used and, next to water, nothing is more injurious to iron and steel.

HOW MONEY TALKS

One Deep Bell and Rattle Costs a Dollar

Telephone companies with long distance connections are rapidly increasing the automatic pay-station boxes which are already found in so many depots and hotels. You step to the telephone, give your order and the operator at the exchange replies the charge will be $1.30, for example. In front of you is an iron box with several slots, each slot marked for the coin it is intended to receive. To pay $1.30 you drop a dollar in the dollar slot, a quarter in another and a nickel in another. Instantly the operator acknowledges the receipt of the full toll, and you are at liberty to talk for the agreed length of time.



"Each Coin Strikes One or More Bells or Gongs"

How does the operator, blocks away, count your money? It is one of those things which are absurdly simple when you know how. As the coin passes down the slot it strikes one or more bells or gongs each having a different sound. A single bell means a nickel, two bells means a dime, one clock gong means a quarter, two clock gongs means a half dollar, and one deep bell and rattle means a dollar.

NEW FLOATING COAL DEPOT FOR BRITISH NAVY

Can Load Two Big Warships at a Time-- Stores 12,000 Tons of Coal

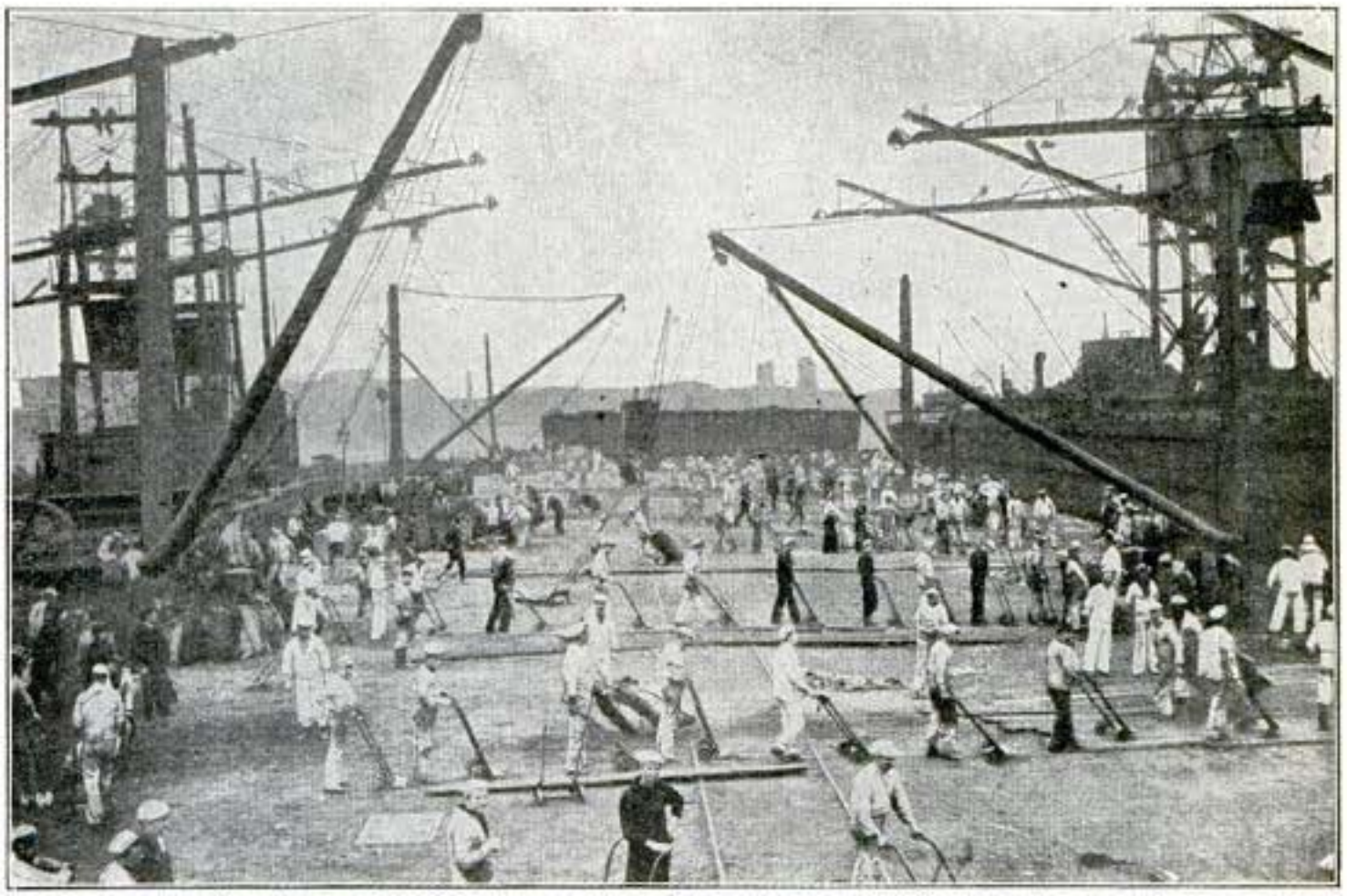
The first of a number of huge floating coal depots that are being constructed for the British navy was tested at Portsmouth, England recently. The depot was tied up to the quay, which was supposed to represent the deck of a battleship and 3,000 tons of coal were delivered over the side and deposited in six hours, according to requirements. This, however, does not represent nearly the amount of work the big transporters on the depot can do. The deck of a battleship has many more obstructions than did the quay used in the test, but it is stated that the transporters can put 600 tons of coal in bags aboard a battleship per hour.

In construction the floating depot is strong and simple, consisting of a large, straight-sided, flat-bottomed hull with bluff ends and divided into seven compartments by six transverse watertight bulkheads. In the middle of the vessel two longtudinal bulkheads divide the five middle compartments into ten coal hoppers. The after-end compartment contains the electric generating machinery and the forward-end compartment is used for crew accommodations and stores, says the Shipping World, London.

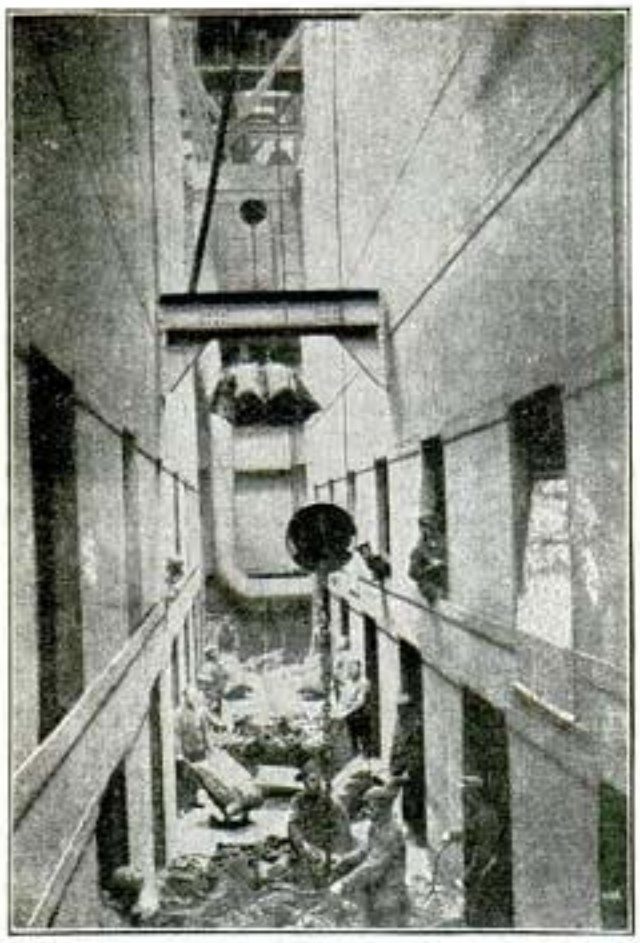
The passageway made by the longitudinal bulkheads has numerous openings to the space under the hoppers, and it is from this place the bags of coal are hoisted. The coal is not shoveled, but flows into the bags, the hoppers being raised above the floor and having chutes for tapping coal from below.

The loading apparatus consists of twelve transporters carried on four traveling towers, which run on a railway laid full length of the depot. The transporters are worked by electricity. There are three on each tower, two of them being of the inclined portable type, which may be used for loading the depot from the collier, or for loading a war vessel from the depot; the third is horizontal and will reach from the hatchway of a collier on one side to the deck of the battleship on the other.

The capacity of the floating depot is for 11,000 tons of coal in hoppers and 1,000 tons



Testing the Handling Capacity of the Transporters on the Quay at Portsmouth



Hoisting Coal in Bags from Depot

in bags, 12,000 tons in all. It has the equivalent of 1,000 ft. of wharf frontage, so that two of the biggest battleships in the English navy may be berthed alongside and coaled at the same time.

TESTING A LOCOMOTIVE

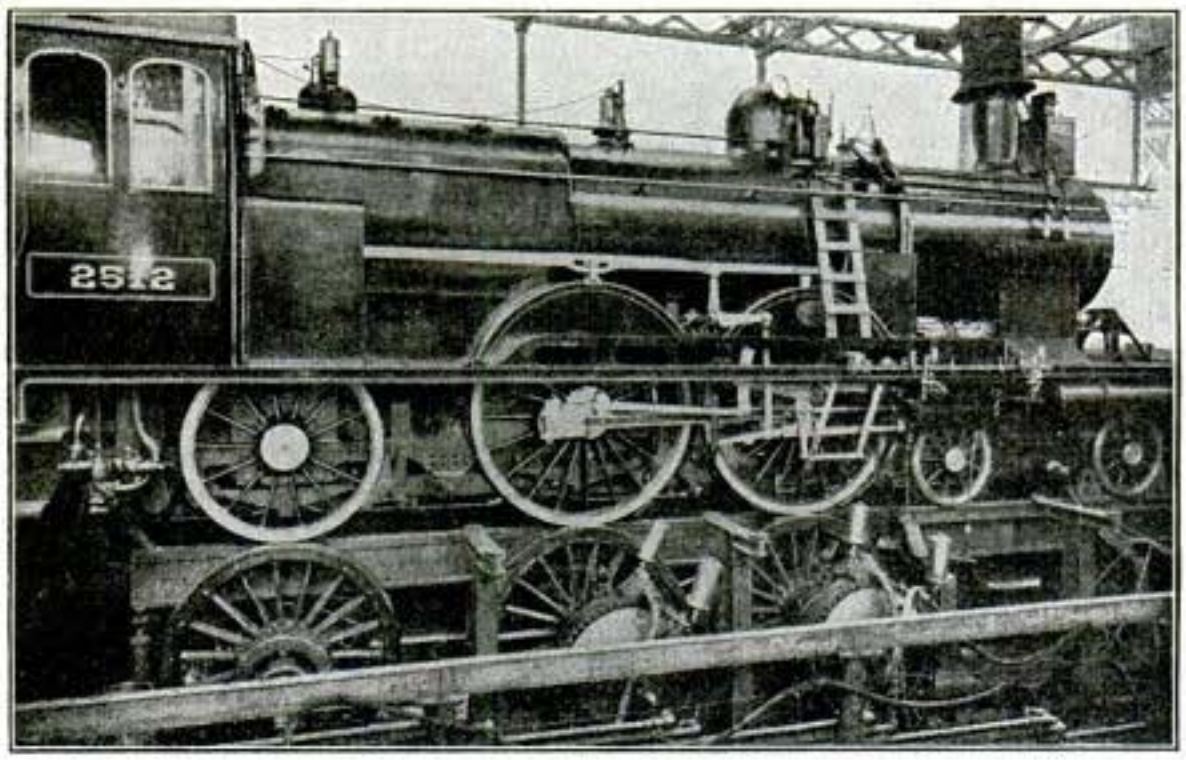
Many of the larger railroads put their new locomotives through a series of elaborate tests before sending them out for regular service.

The illustration from the Railway Age shows the testing plant of the Pennsylvania railroad. The locomotive is run onto the testing frame, with the driving wheels resting on wheels which can be moved to suit each case. The locomotive can then be operated at full speed and though the drivers are turning at a rate which would mean 80 miles or more an hour out on the main line, it does not advance an inch. Numerous delicate recording instruments are attached to various parts of the locomotive, and when the test is ended complete records drawn with ink on rolls of paper form a complete history of how well each part has performed its work.

SLIGHTLY WARM

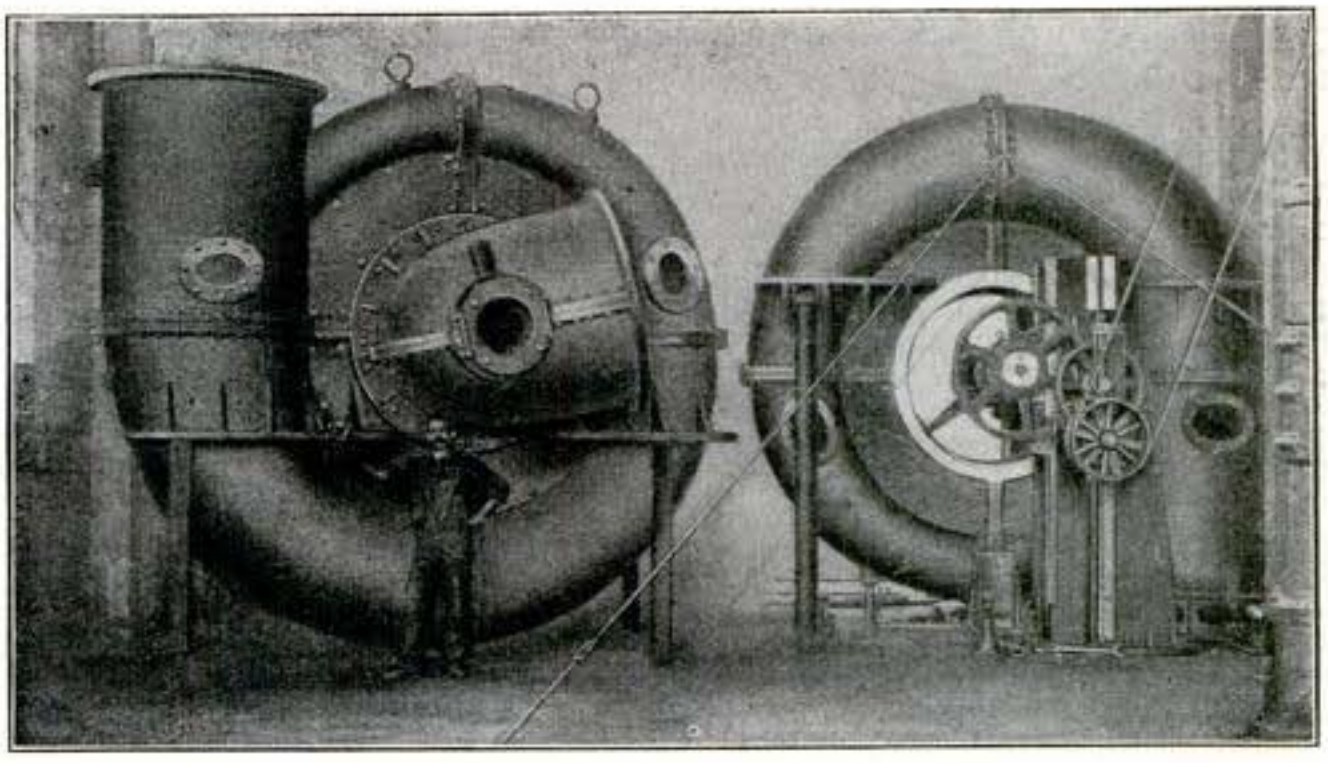
Prof. Langley says: "The heat of the sun is enormous beyond conception, for there is enough to warm two thousand million worlds like ours. Every minute there is enough of the sun's heat falling to the earth to raise to boiling thirty-seven thousand million tons of water. But the heat which thus falls on the earth is not a thousandth part of 1 per cent of what the sun sends elsewhere, and all the coal beds of Pennsylvania, for instance, though they can supply the country for hundreds of years, would not keep up this heat during the one thousandth part of a second."

To a man who buys his coal by the basket this is, to say the least, interesting.



Balanced Compound Locomotive on a Testing Plant Ready to be Tested

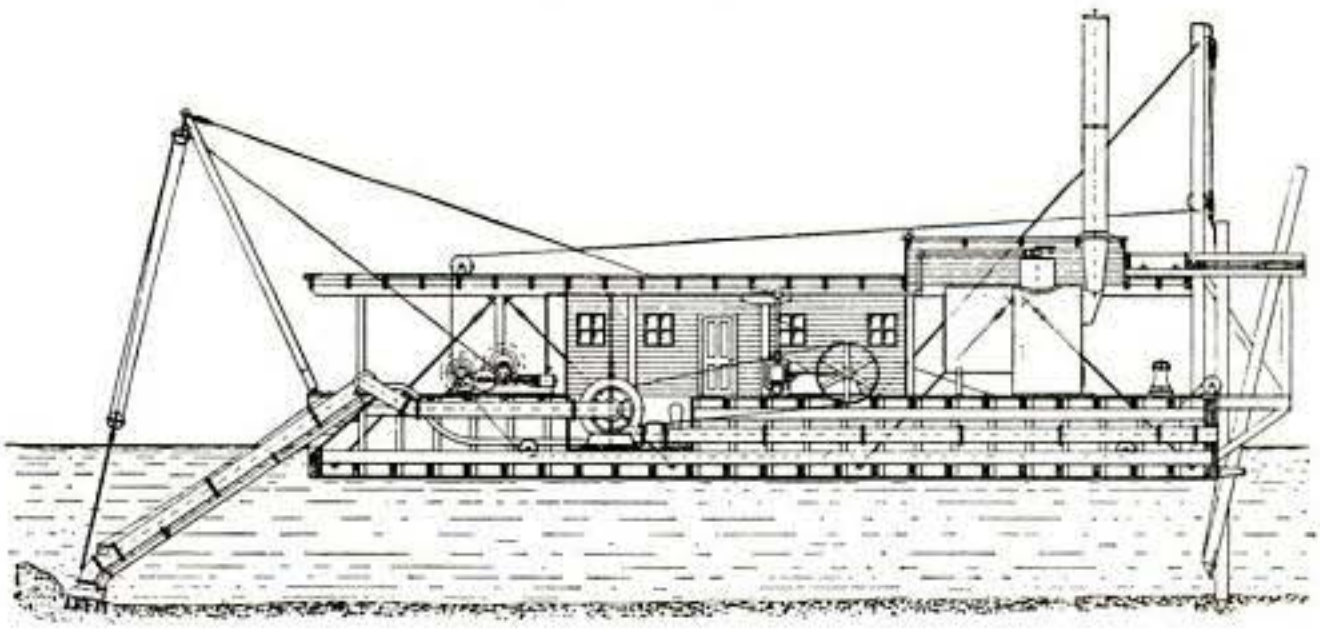
THE LARGEST DREDGING PUMPS EVER BUILT



Suction Dredging Pumps that Handle 6,000 Cu. Yd. Material per Hour, Each

Two large cast-iron dredging pumps, each having a 48-in. discharge opening and capable of handling 6,000 cu. yd. of sand and gravel per hour under favorable conditions are used for deepening the inlet to the New York harbor. They are the largest pumps of the kind ever built and are each mounted on a hydraulic dredge of the hopper type,—i. e., having a number of large hoppers built into the hull.

Each pump is 16 ft. in outside diameter, weighs 60,000 lbs. and is driven by a horizontal cross compound engine of 1,600 h p. capacity. The pump suction is equipped with a 48-in. suction pipe extending from the hull down to the bottom to be dredged, and on the end of this suction pipe there is a suitable inlet nozzle, so made that the dredge can either lay stationary or steam along slowly while the sand and gravel are sucked in through the suction nozzle. The material picked up by the suction is delivered by the pump into the hoppers in the dredge boat, the water overflowing over the side of the dredge. After these hoppers are filled the dredging operation stops and the boat is steamed out into deep water where the hoppers are dumped, after which it again returns to the bank on which it is dredging.

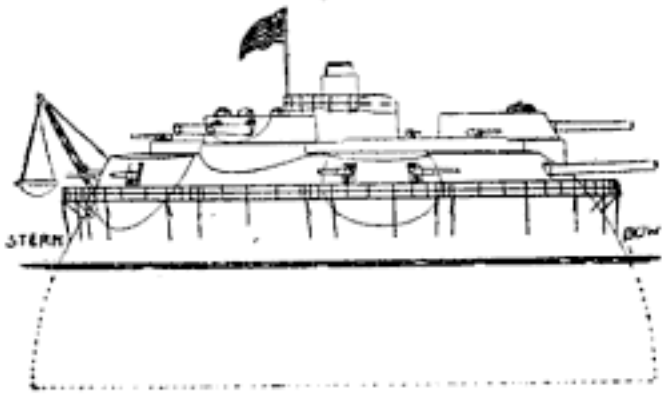


Plan of Suction Dredge

CIRCULAR FLOATING FORT

At the recent meeting of the Society of Naval Architects, in New York, A. P. Stokes submitted plans for a semi-globular naval battery. While the floating fort would be able to travel slowly under its own steam, it would need a tow for any considerable distance. Mr. Stokes says:

"I was led to this invention partly by seeing, while yachting in the Caribbean,



Proposed Floating Fort

a remarkable little island called Diamond Rock, one mile off the southwest coast of Martinique. It is about 800 feet square, 574 feet high, and with precipitous sides. Diamond Rock was formerly rated as a sloop-of-war on the books of the British Admiralty. In January, 1804, Sir Samuel Hood laid his seventy-four gun ship "Centaur" close alongside this rock, to the top of which he made fast a hawser on which was a traveller. He then hauled three long twenty-fours and two eighteens to the top and left them in charge of Lieutenant Maurise, with one hundred and twenty men and boys, with ammunition, provisions and water. The crew built a cistern. For fifteen months this novel sloop of war did great injury to the French shipping going to and from the neighboring harbor, now called Fort-de-France, until June 1st, 1805, when she surrendered for want of powder, to a French squadron of two seventy-fours, a corvette, a schooner and eleven gunboats. In this engagement the stone sloop-of-war, Diamond Rock, killed and wounded seventy men, and destroyed three gunboats, with a loss to herself of two killed and one wounded."

The cut shows battery planned for 180 feet diameter at base with weight of armor equal to 48 per cent. of its displacement.

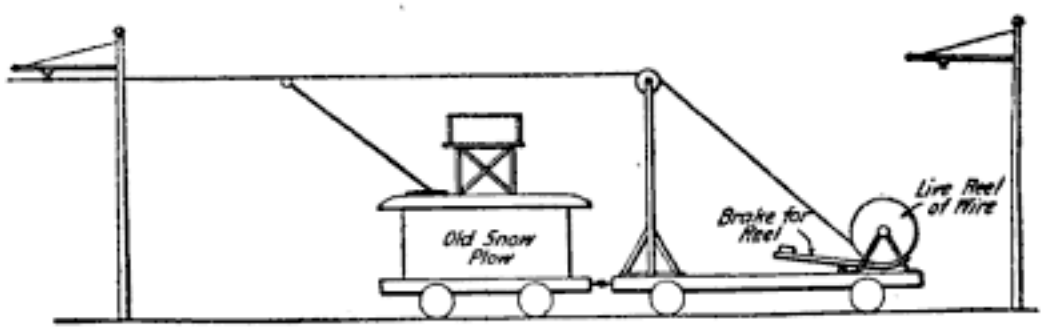
IRON CURTAINS IN GERMAN THEATERS

Iron curtains for separating stage and auditorium have been installed in nearly all German theaters. The curtains are operated by hydraulic, electric or manual power. An expert, criticizing them, says that they often fail to move when it is desired to reassure the audience and that the rattling noise alarms the people. At the Berlin Opera House on one occasion the iron curtain was dropped between acts, but could not be raised again and the performance was abandoned.

The possession of two iron curtains may be made obligatory so that one will act in case the other fails, or if this is impossible, a second curtain of asbestos with an iron filling may be used. The expert advises a space of 39 to 58 in. between the curtains, supplied with ventilators at the top so that smoke and gases cannot penetrate to the auditorium. The expense for these curtains would be less than for hiring an increased number of theater firemen.

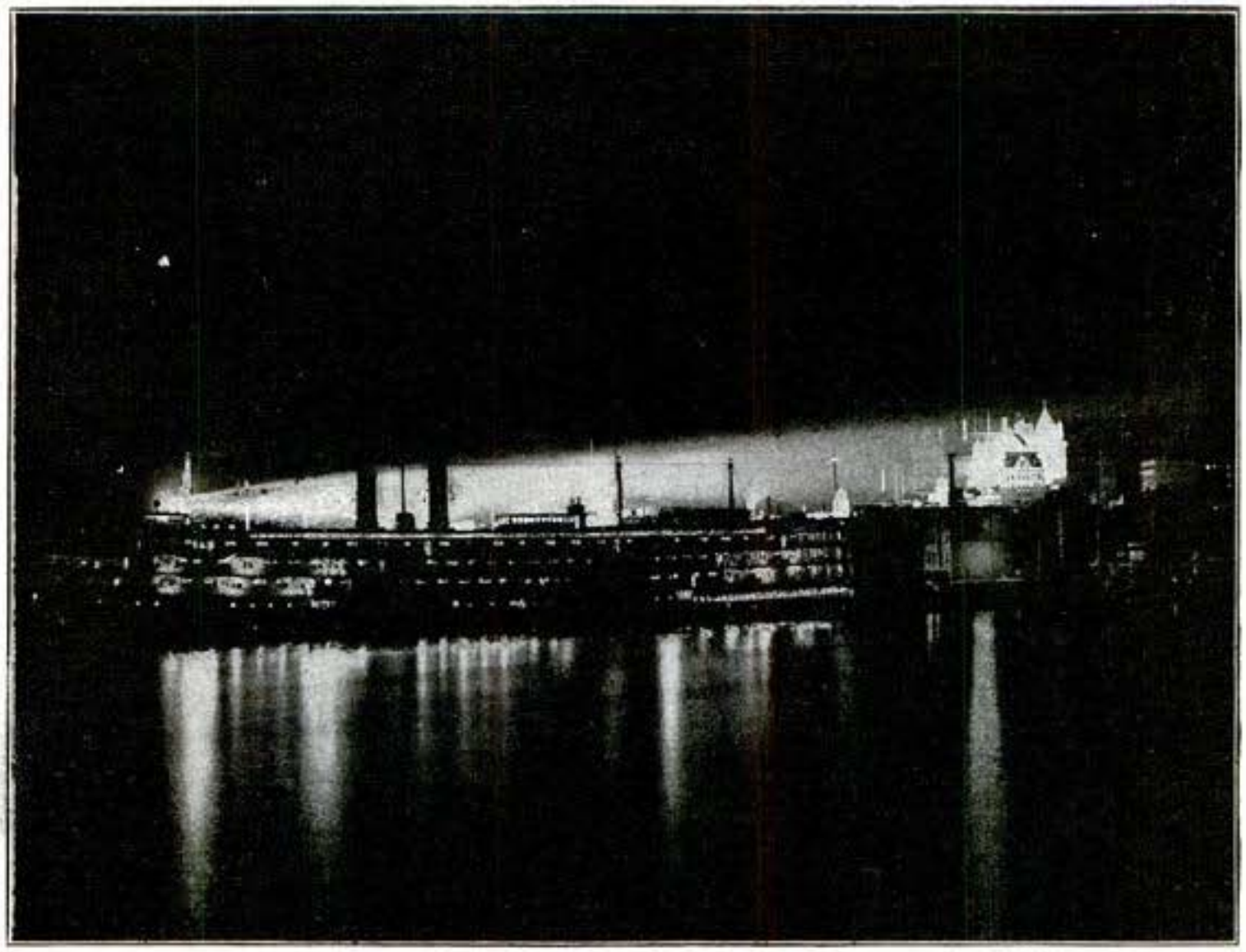
LABOR-SAVING TROLLEY LINE STRINGER

On the principle of the track building cars used on the steam roads in track construction, the Street Railway Journal describes a plan for stringing trolley wires. This, of course, contemplates the previous construction of the track. The trolley wire is strung out alive, the motor car, for which a snow plow can be used, taking current from the overhead wire.



Strings Its Own Trolley Wire

ARTIFICIAL MOONLIGHT



Hudson River Scenery Seen by Searchlight

On the Hudson river where the scenery on either side is unsurpassed for grandeur, pleasure excursions by night are many. Not, however, the time-honored moonlight excursions only, but excursions on very dark nights also, when the scenery is flashed upon the delighted vision by means of powerful searchlights. The effect produced by this means is fantastic and beautiful in the extreme, as each succeeding phase of the panorama is brought out in a radiance of light against the dark background of the night, and then as suddenly lost as a new view succeeds it.

In our illustration is shown one of these pleasure boats, the "C. W. Morse," fitted with a 36-in. projector illuminating the capitol at Albany, N. Y.

Naturally the field for such powerful lights is a wide one. In marine service, on yachts, dredges, passenger steamers, and merchant vessels of all kinds, or for picking up buoys in the channel, in towing rude log rafts, or lighting the scene of an accident they may now be found in efficient service. They have found a place in advertising and exhibition work, in mines where hydraulic operations are carried on at night and in many other inland enterprises. In the South African war many of them were used in protecting armored supply trains. The largest commercial size of projectors is 18 inches in diameter, but for some special purposes they are manufactured in sizes up to 80 inches.

GUM WOOD FOR FURNITURE

Red gum wood, or satin walnut as it is known in Europe, is being used in the manufacture of furniture. Unless well seasoned it warps badly, but when thoroughly dried remains in place and readily takes a high polish. European manufacturers will not use a piece of wood which has not had from three to five years natural seasoning.

TURNING PLANTS OUT OF POTS

This is one of those things which is less easy to do than appearances would indicate. By following the directions given in the

FIG. 1.

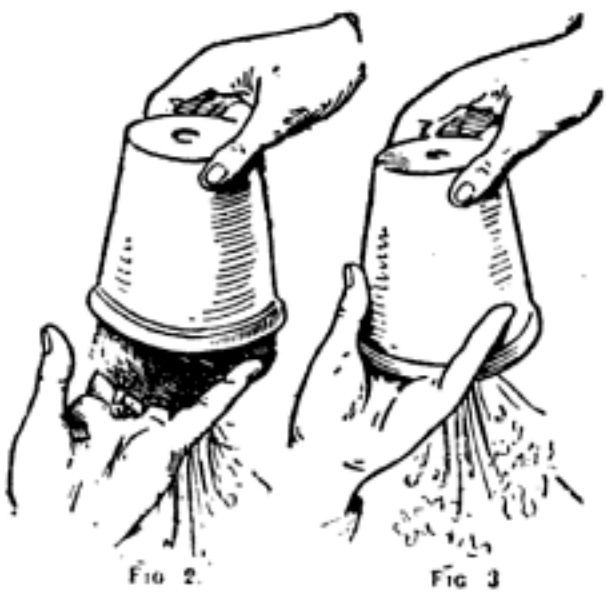


FIG. 2. FIG. 3

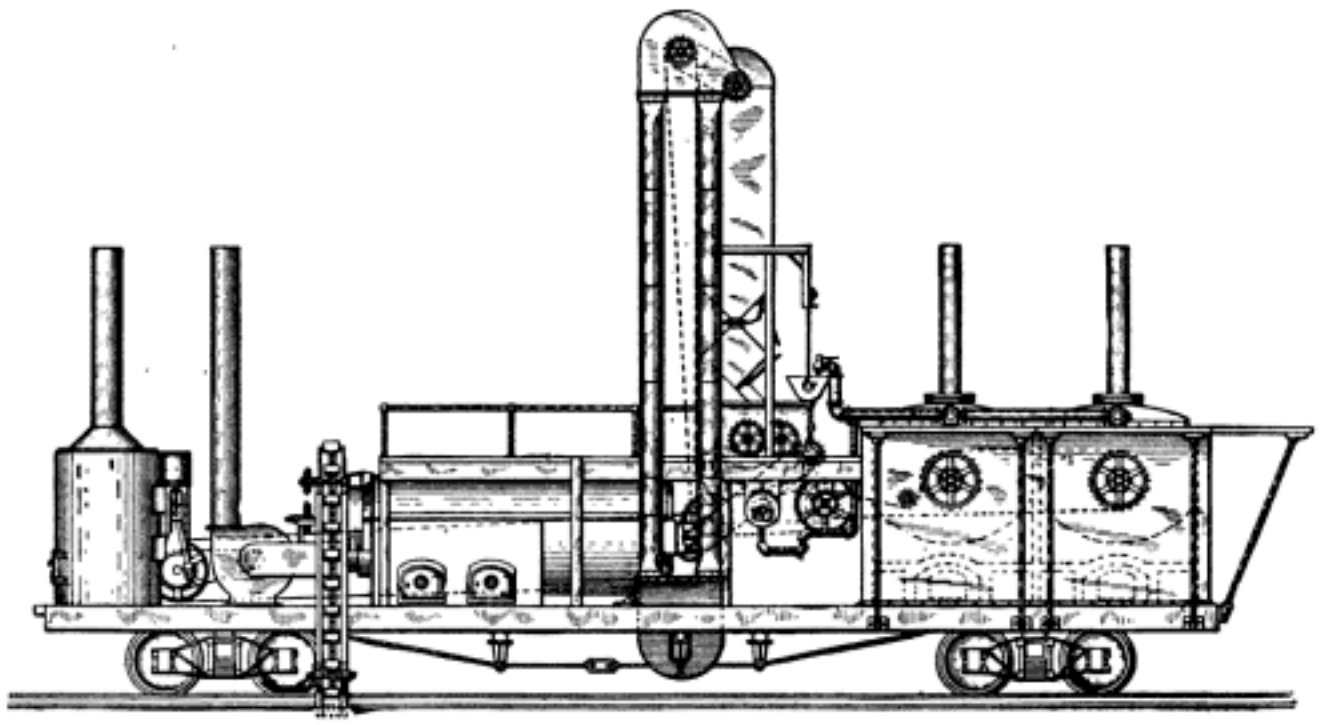
Right Way is Easy

Gardener's Magazine you can become as expert as any professional gardener.

Place the fingers over the soil, with the plant stem between them (Fig. 1); invert, and, holding the pot with the other hand, give the rim one or more sharp taps on the front edge of a solid bench. This will cause the ball of soil to slip out of the pot (Fig. 2), and, holding it bottom upward, it may then be subjected to the necessary examination. This completed, put the pot over the ball (Fig. 3), press it down, and turn the right way up. Then, keeping the fingers firmly on the surface of the soil, give the pot one or two sharp taps on the bench to settle the plant in its place. This little operation will also prove the advantage of using perfectly clean pots for potting, for if the pots are dirty inside, when used, the new soil and new roots will stick to it in such a way that when an attempt is made to turn the plant out for examination the ball of soil becomes broken and many roots are damaged.

RAILWAY ASPHALT PAVING PLANT

Contractors who are taking paving contracts in different cities now move their plant when they finish in one town and go to the next. But there is no tearing down of buildings in one place and loss of time in erecting them again in another. The entire "plant" is built on a specially constructed railway car and the moving is all done by a switch engine and regular freight train. On arrival at destination the plant is sidetracked at some point convenient to the work and goes immediately to work. The outfit includes two melting kettles, sand drier, mixing machine, elevator, conveyors, boiler, engine and air compressor.



Single Car Asphalt Plant Ready for Use

HOW CAN THE WEAR ON LOCOMOTIVE WHEEL TIRES BE DECREASED?

In 1883 a locomotive drive wheel carried 13,000 pounds on a 65-pound (per yd.) rail 19,000 miles, wearing away one-sixteenth of an inch in thickness, while with the same loss, in 1896 the average wheel carried 20,000 pounds on a 100-pound rail, 29,000 miles. The reasons for this are: Improved steel, better shaped rails and wider rail head. But the weight per wheel now is three times that of 25 years ago, so that 25,000 pounds per wheel, and high speed are wearing rails and tires more rapidly than ever. The question is, "What can be done in making the steel, to give longer life to the wheel tires?"

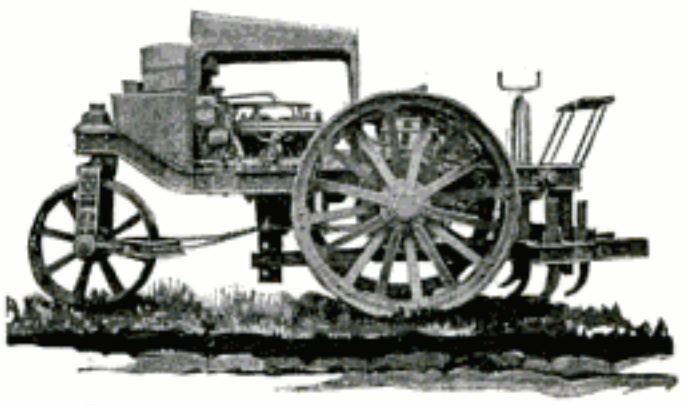
"It has been clearly shown that heat treatment in the process of the manufacture of tires is far more important than slight difference in chemical composition,' says the Railway Age. Experiment has proved that tires finished when too hot are not strong.

It has been found that a coarse steel will give way under a pull more easily than a fine grained piece The inner particles do not seem to be well locked together. A fine, hard, tough steel will best stand a shock or strain, because it will pass the jar or strain on to the neighboring parts. The last point is illustrated in rifle steel and metal used for heavy guns. Tires made of coarse metal, flake, while those of fine grain steel wear smooth.

Concluding, it seems that coarse steel and methods of its manufacture are to blame for the rapid wear and breakage of locomotive tires.

PECULIAR MOTOR VEHICLE MACHINES

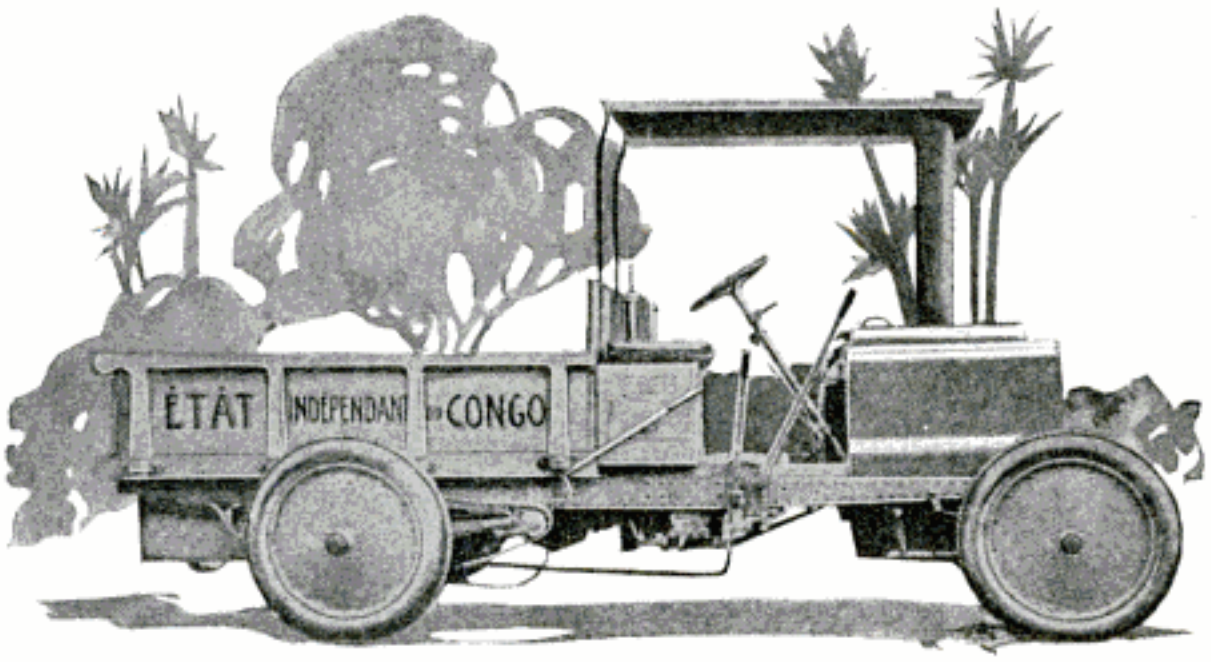
One of the important possessions in the Congo Free State, central Africa, belongs to Belgium. The transportation facilities are



French Motor Plow for Use In Egypt

limited to the Congo river and a few hundred miles of single track railway. The transportation of troops and their supplies to the interior has proved troublesome. To improve these conditions the King of Belgium has had built some 15-hp. motor cars, one of which is shown in an illustration from the Motor Age. The difficulty of securing gasoline is great, so the machines are steamers burning wood for fuel. Each car weighs 2,200 lbs., and will haul one ton at 12 miles an hour over rough roads.

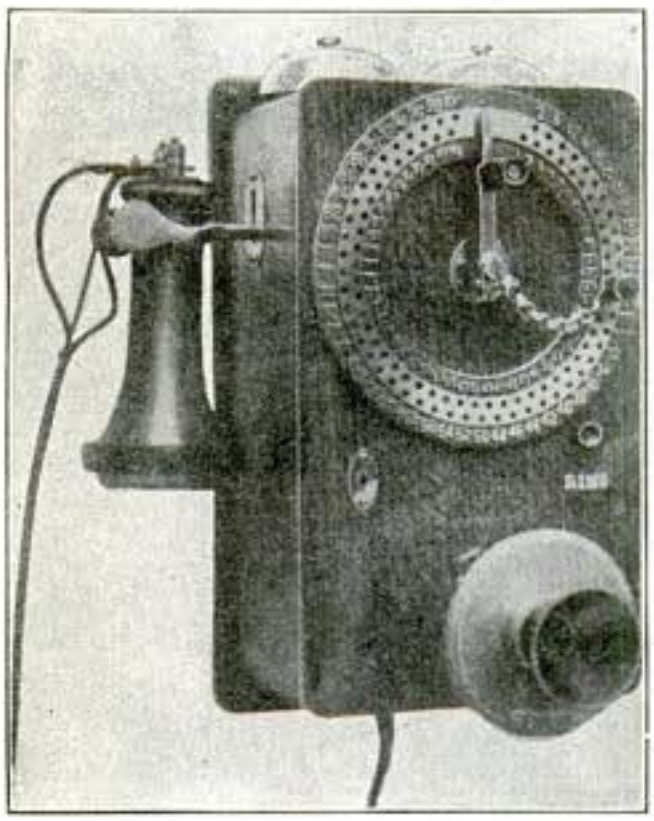
Another peculiar motor machine has been built in France for plowing in Egypt. This is a gasoline machine of 28 hp. which has a speed of 2½ miles an hour drawing seven plows The plow will do the work of six teams, and the cost for gasoline is only $4.50 in Egypt. In this country the same amount of gasoline will cost only $1.35.



A Belgian Motor Wagon In Africa

SMALL TELEPHONE EXCHANGE WITHOUT OPERATORS

In the town of Chagrin Falls, O., an automatic telephone exchange has been installed, one hundred patrons being able to use the system without the necessity of an operator. The telephone instrument used by each subscriber is shown in the cut In



Telephone Instrument Used by Subscribers to the Automatic Exchange

using it the receiver is first taken down, the pointer is placed at the desired number of the dial and then released when immediately the selector connects with the desired line. The exchange comprises a complete centralized battery system with all the features of the usual telephone exchange. At the central office the apparatus for each line consists of a 100-line selector with four relays and two consensers which are mounted on slanting shelves. The selector comprises an insulated ring holding 100 pairs of line terminals. The connecting arm within is rotated by an electro-magnet. This automatic telephone exchange provides for both a day and night service and the cost of the service is of course notably reduced.

Buenos Aires, the best lighted city in the world, is to discard its 3,000 horse-drawn cabs for electric vehicles.

ELECTRIC CURRENT OF 500,000 VOLTS FAILS TO KILL

Professor Elihu Thomson, of Lynn, Mass., before the Commercial Club of Boston on June 8, allowed a current of 500,000 volts of electricity to pass through his body and then, releasing himself from contact, stepped forth to laugh at his horrified spectators. Sparks and darts of fire flashed from the professor's body during the experiment, but he declares he suffered not the slightest discomfort nor injury. The reason 2,000 volts will electrocute, while 500,000 volts will not harm, Prof. Thompson explains, is that with the weaker current the nerves vibrate before the current and death results; but a current of a half million volts vibrates so quickly that it passes through the body before the nerves are affected.

ELECTRIC LIGHT IN HUMAN BODY

The surgeon of today is no longer literally in the dark in his exploration of the cavities of the human body. Electrical science has come to his assistance and provided an electric light which can be inserted in the stomach, for instance, by insertion through the mouth and esophagus It is not, of course, a large arc light such as are suspended at street corners but a tiny incandescent lamp, whose power is greatly reduced by means of a transformer, from the

For "Interior" Lighting

ordinary office or house light. The lamp is inclosed in a small tube which prevents the glass globe, not much larger than a bean, from touching the flesh. A strong reflector assists in producing an intensely brilliant light.

THE HARNESSING OF HEAT

PART III--Steam

What we ordinarily call steam is not steam at all, but simply a cloud of very small particles of water floating in the air. Steam itself is as colorless and invisible as air. This can easily be proven by boiling water in a glass flask, or even by noting the space above the water in the gauge glass upon a boiler.

The most remarkable thing about steam is the immense amount of heat it contains. Water, from which steam is made, is itself remarkable for the large amount of heat it will absorb. To raise one pound of water from a temperature of 32 deg. Fahrenheit to 33 deg. Fahrenheit, one heat unit is required. This unit is sometimes called the British Thermal Unit (B. T. U.) To raise the temperature of a pound of water one degree, requires approximately the same amount of heat at all temperatures below the boiling point. So to raise one pound of water from 211 deg. F. to 212 deg. F. will require one heat unit. But as soon as we reach a temperature of 212 deg. F., under normal conditions, and begin to apply more heat, the water begins to change from a liquid to a vapor; that is, to change from water to steam. Now, the remarkable thing about the process is this, that while it takes only one unit of heat to raise the pound of water from 211 deg. to 212 deg. F., it takes nearly 965 times as much heat to change this same pound into the same weight of steam at the same temperature. Because of the fact that the heat which must be applied to water to change it into steam, will not cause a rise in temperature, this heat has been called "latent" or hidden heat. The heat absorbed by one pound of water in converting it into steam at atmospheric pressure, is sufficient to have melted three pounds of steel, or thirteen pounds of gold. The change from a liquid to a vapor has caused the water to expand so that when converted into steam it occupies 1,600 times as much space as it did when in the form of a liquid.

It has been stated that steam is formed when water reaches a temperature of 212 deg. F. This is true under normal conditions of the atmosphere, but not always true. If by any means the pressure upon the water be increased, it will not change into steam so readily, and we have to heat it above the temperature just mentioned. If, on the contrary, we decrease the pressure upon the water, it boils at a lower temperature. At the top of high mountains, where the atmospheric pressure is low, the boiling takes place at such a low temperature as to make cooking more difficult than under ordinary conditions. In sugar refineries, where it is necessary to boil a solution of sugar at an extremely low temperature to avoid burning, the solution is placed in "vacuum pans" from which the air is partially exhausted, thus lowering the boiling point.

In steam boilers, we have a case of extraordinarily high pressures. So we would expect that the water in a boiler would not boil at as low a temperature as it would in an open vessel. With a gauge pressure of 125 pounds, the temperature of the steam is in the neighborhood of 352 deg. F. The water in a boiler under these conditions is far above its normal boiling point, and is only prevented from changing to steam by reason of the great pressure upon it. Suppose the pressure to be suddenly removed. The water in the boiler will instantly burst forth in the form of steam, increasing its volume many hundreds of times. This explains the severity of boiler explosions. It is not so much the steam already in the boiler that causes damage as the immense volume of steam let loose from the once imprisoned water, by the rending of the plates of a boiler.

Heat is a form of energy, and as such may be made to do work. Since steam is such an excellent absorbent of heat, it may be made to serve as an agent for the transfer of heat, and for the conversion of the energy it holds into useful work. The steam engine is simply a machine in which the heat energy resident in steam is transformed into the energy of motion. The problem of the economical design and running of a steam engine resolves itself into the question of how to use to the best advantage all the heat in a given amount of steam.

Upon being cooled, steam condenses, that is, changes back to the form of water. It then gives up all the heat which it absorbed when vaporized. This explains the severity of burns caused by steam, as compared with those from other sources. The immense amount of heat given out in condensation

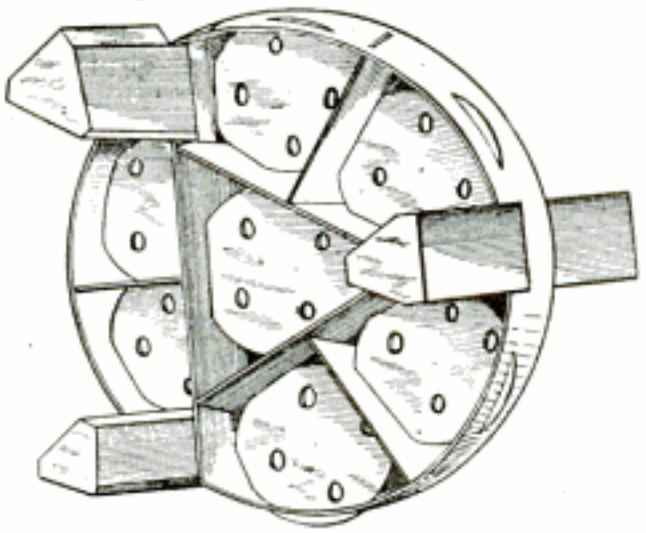
is the basis for the successful working of the many systems of steam heating of buildings.

The subject of superheated steam is an interesting one. This term is applied to steam whose temperature has been raised above that which it would naturally have for a given pressure. The effect of this is to add an extra amount of energy to the steam, enabling us to do more work with it, and avoiding some of the difficulties which are met with in the use of ordinary steam. One of these difficulties is cylinder condensation in an engine; that is, the condensing of the steam as it enters the cylinder of an engine, due to contact with the cold walls of the cylinder. But the use of superheated steam brings in other difficulties. Chief among these is the difficulty of securing proper lubrication at high temperatures. It has been found that 400 degrees is about the highest temperature we can work with in an engine. Now we can secure a temperature of 370 deg. F. in the steam by the use of ordinary saturated steam at 150 pounds pressure, so that the advantages gained by the use of superheated steam are not so apparent, when we consider the complication of apparatus it involves and the increased cost and wear of machinery designed for its use, always important items.

A NEW UNDERGROUND CABLE SYSTEM

[Excerpts from Article in Electrical Review, London, by Axel Hultman, Manager of the Government Telephone Exchange, Stockholm.]

The rapid extension of the telephone early necessitated the placing of subscribers' lines underground, and to-day there is no large modern telephone system without underground cables running out of the central office. Not only town lines, however, have to be laid in this manner, but also the long-distance lines, i. e., the lines between cities, which become numerous in the neighborhood of important centers, must also be laid



Section of Conduit

in some similar manner, for it becomes impossible to build the ever-increasing pole lines along railways and country roads, especially as these routes are often occupied by power circuits.

The number of long lines in the neighborhood of Stockholm having become inconveniently large, the Swedish Telegraph Administration began experimenting in 1892 with a cheap mode of running lines, and has continued the experiments ever since.

The capacity of long underground circuits must be kept as low as possible, which involves wide air spaces between conductors, air being the best of all insulating materials. The problem is therefore two-fold—

1. To make the conduit cheap and yet air-tight throughout, and at the same time to afford a complete mechanical protection to the conductors.

2. So to place the conductors in the conduit as to prevent induction and maintain permanently their relative positions.

While experiments have been made with lead-covered paper cables containing heavy copper wires, spaced as far apart as possible, it is doubtful whether the problem can be solved in this manner at a reasonable cost, for a wide spacing between wires cannot be obtained without an increase of outside diameter and a corresponding increase of cost; then, again, such heavy lead cables are difficult to transport and to lay. On the other hand, in the system which I have succeeded in working out, the conductors can be spaced as far apart as permitted by the limits of cost and room available in each case, and without a considerable increase in the cost of materials.

The conduit is an iron pipe laid in cement, along railroad tracks, close to the surface of the ground. To maintain the wires in place a disk is used which is placed at intervals of two feet. These disks are threaded with the wires at the factory and wire and disks wound on reels to be drawn into the conduit by hand.

A 1,000-ft. section can be drawn into the conduit in a few minutes.

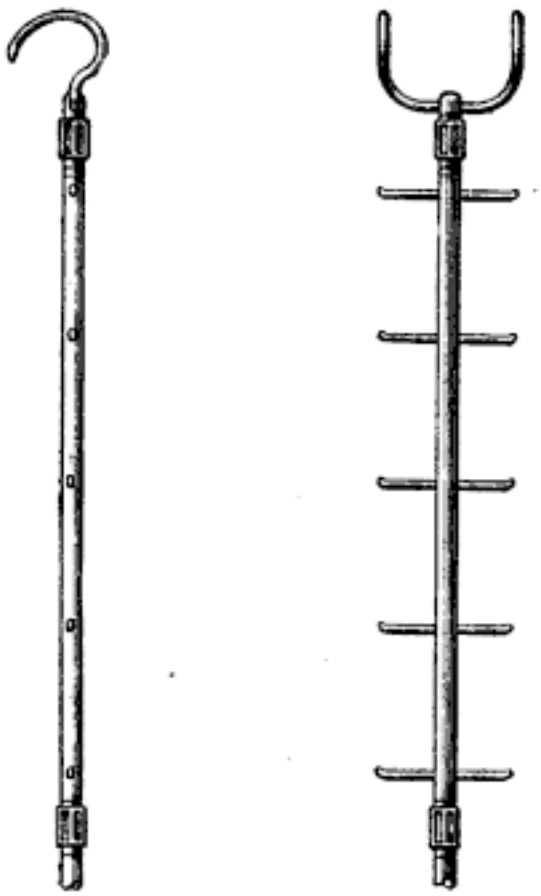
All the articles appearing in this department are reprinted in book form at the end of each year.

SHOP NOTES

Contributions to this department are invited. If you have worked out a good idea or know of one, please send it in.

HANDY EXTENSION LADDER

A very handy extension ladder can be made of 1-in. pipe and the teeth of an old horse rake, says a correspondent of Domestic Engineering. Take the teeth out of the rake, heat them in the forge to strengthen them, but do not burn, and cut them up into 20-in. lengths, or to the best advantage. In an 8 or 10-ft. length of 1-in. pipe punch holes about 12 in. apart and just



Pipe Extension Ladder

large enough to allow driving the pieces of steel through tight.

Make a double prong of the steel at the upper end, shaped to hook over a joist or other support. Weld the prong into a stub of 1-in. pipe that will screw into a coupling. Make as many sections of ladder as you are apt to need.

In England public bakeries are not allowed to conduct operations underground or in basements, on account of sanitary reasons. If the offense is not corrected after 14 days' notice the owner is arrested and the place closed.

ROPE SWAB FOR ENGINE ROOM

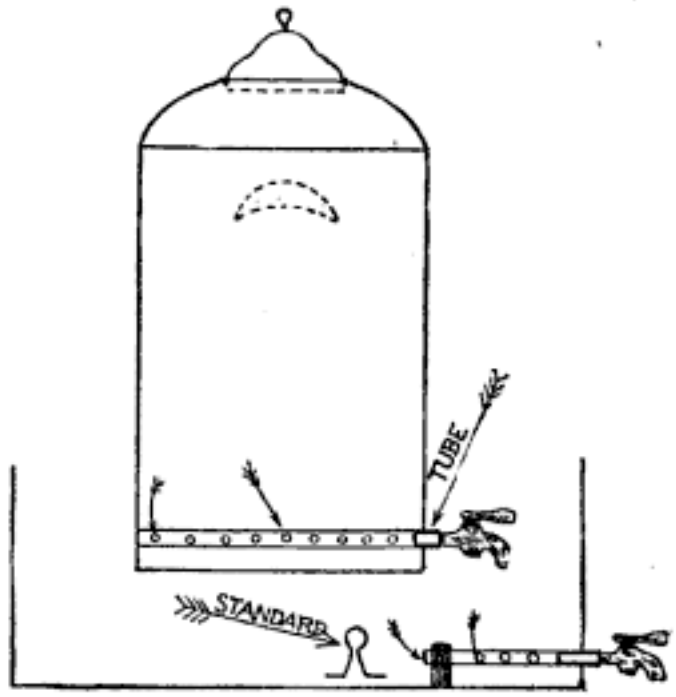
Cotton clothesline is the proper rope to use for a polishing swab, says a correspondent of the Engineers' Review. Have

Soft Rope Swab

about five strands of the rope and twist and wrap them as shown in the illustration. Tie the ends securely to prevent raveling.

TO SOLDER FAUCETS ON COPPER KETTLES

Do not use a boss or any kind of a brace in securing a faucet to a copper kettle, says a correspondent of the American Artisan. Instead, make a tube the size of the faucet; punch a number of holes in it; solder it to the faucet, run it through the kettle and solder it at the rear of the



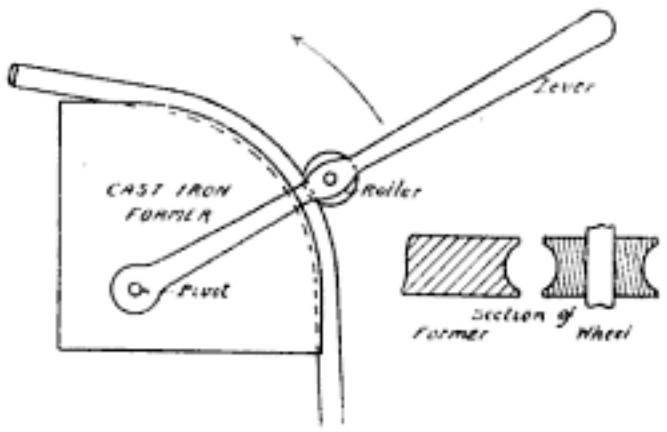
Soldering a Faucet on a Copper Kettle

kettle and, also, at the faucet. This is for round kettles.

Where a kettle is boiler-shaped, with a faucet at one end, make the tube about 8 in. long and for the inner end provide a standard, fastening the standard to the bottom of the kettle.

PIPE-BENDING DEVICE

The illustration shows a handy mandrel or former for bending iron piping while hot. A lever and roller is used to press it into shape. Copper piping may be bent while



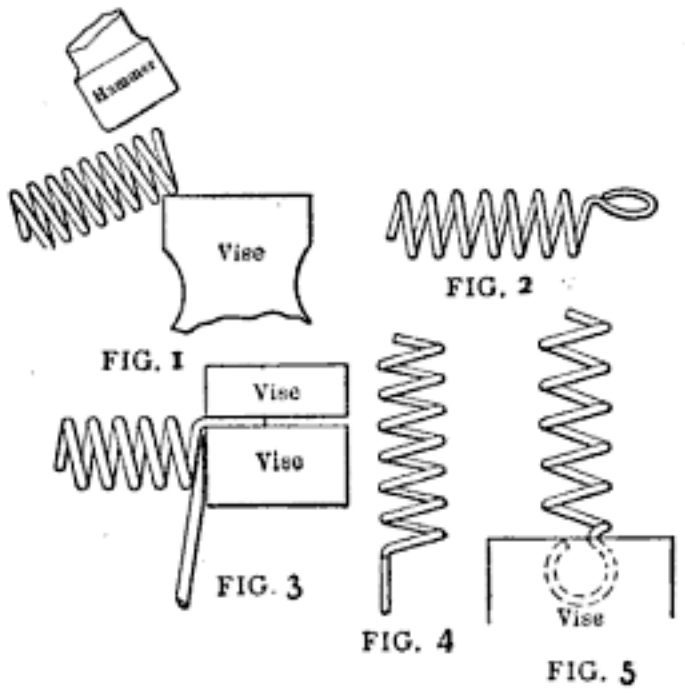
Pipe-Bending Appliance

cold in the same way, but should first be filled with molten lead to prevent buckling, says the Model Engineer. Remove the lead by heating the pipe.

BENDING A SPRING LOOP

It is easy to bend a loop on a coiled spring in the following way, says a correspondent of the American Machinist.

Hold the spring in the left hand so the first coil is over the edge of the vise-jaw, the end of the spring being upward as at Fig. 1. With a hammer strike a quick blow on top of the spring, so causing the first coil to open out nearly at right angles to



the spring (Fig. 2). Catch this first coil in a vise, as at Fig. 3 (top view); force a screw driver in, as shown, and get the coil set in line (Fig. 4). To set the ear central, clamp the ear upright in the vise (Fig. 5) and, using a hammer, punch as close to the top of the vise as possible.

CEMENTS FOR STEAM AND WATER JOINTS

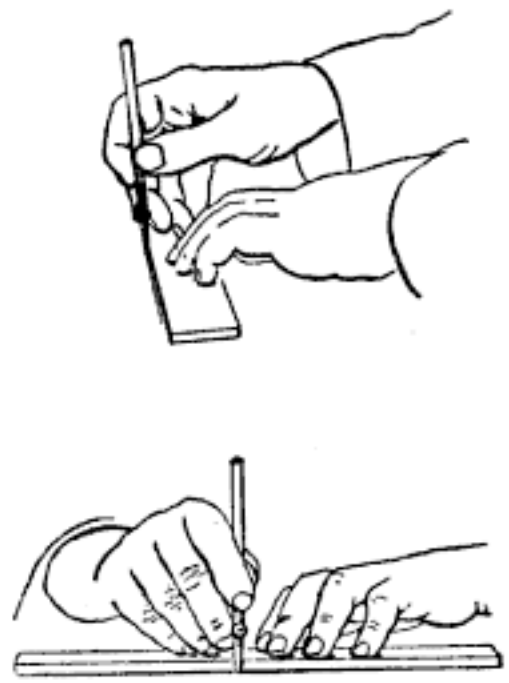
1. Black oxide of manganese mixed with sufficient raw linseed oil to bring it to a thick paste. Remove pressure from the pipe and keep sufficiently warm to absorb the oil while the cement is being applied to the joint or leak. This cement is recommended by a correspondent of Machinery, who says it will be as hard as the iron pipe in 24 hours.

2. With boiled linseed oil mix together to the consistency of putty the following ingredients: Ground litharge, 10 lb.; plaster of paris, 4 lb.; yellow ochre, ½ lb.; red lead, 2 lb.; hemp cut in ½-in. lengths, ½ oz.

3. Another good one consists of white lead, 10 parts; black oxide of manganese, 3 parts; litharge, 1 part. Mix with boiled linseed oil. Recommended by the Monumental News.

HOW TO HOLD THE RULING PEN

In ruling, hold the pen at right angles to the paper, not allowing the point to reach out or in from the straight edge, or it will

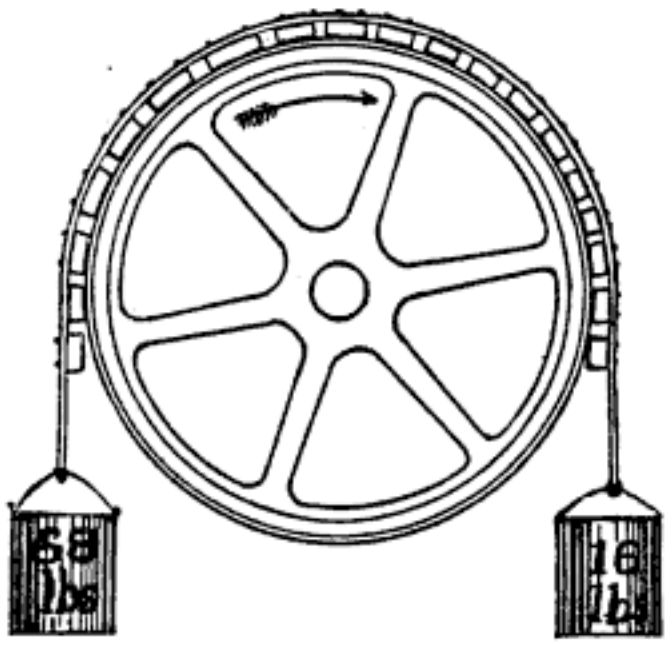


Hold the Ruling Pen Like This

make a ragged line. If it reaches in, the ink is apt to run under the straight edge and make a blur.

TO DETERMINE BRAKE HORSEPOWER

To determine the brake horsepower of an engine attach cleats of pine, basswood, or other soft wood, to a piece of a belt and hang it over the fly-wheel as shown in the illustration. Fill two paint buckets having handles with small pieces of iron or small stones and attach to the ends of the piece of belt. When the engine is running, weight the buckets until they balance and the engine is pulling a full load without decreasing its speed. Count the speed, says the American Miller, while it is running under this load, and when satisfied you have determined the number of revolutions it will



Test of Brake Horsepower

make under the load, stop the engine and weigh each bucket.

Find the difference in the weight of the buckets, which is the number of pounds pulled by the engine Multiply the circumference of the wheel in feet by the number of pounds pulled, by the number of revolutions per minute, and divide the product by 33,000. The result will be the brake horsepower.

With a flywheel 2½ ft. in diameter, capable of making 300 revolutions per minute while pulling 52 lb., one would proceed as follows:

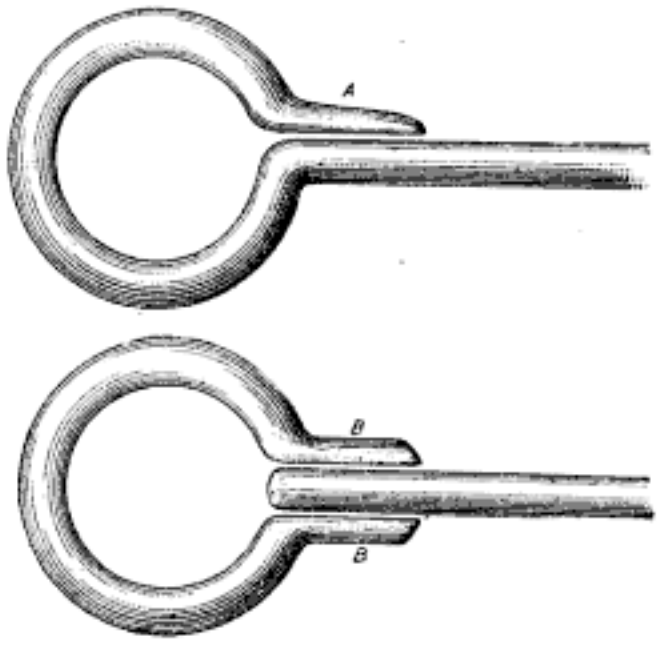
2½ ft. × 3.1416=7.85 ft., circumference.

$$\frac{\text{Cir.} \quad \text{Rev.} \quad \text{Lbs.}}{7.85 \text{ ft.} \times 300 \times 52} = 3.7 \text{ h. p.}$$
$$33{,}000$$

For straining paint uses millers' bolting cloth. For ordinary purposes 5-cent cheese cloth will do.

SEVERAL METHODS OF MAKING A SOLID EYE

In making a solid eye, to upset the ends of the rods and punch the eye is a poor method, says a correspondent of the Black-



Making a Solid Eye

smith and Wheelwright, as the upsetting tends to open the fibers of the iron. There are a number of ways of making a solid eye, the merits of each depending a good deal on what the eye is for and its size.

The rod may be partially upset and drawn down, or the eye may be made and welded on to the bar. In Fig. 1 the eye is made by bending the rod round to form the eye, first drawing the point and welding it at A. As shown in Fig. 2, a tongued joint is used, welded at B B.

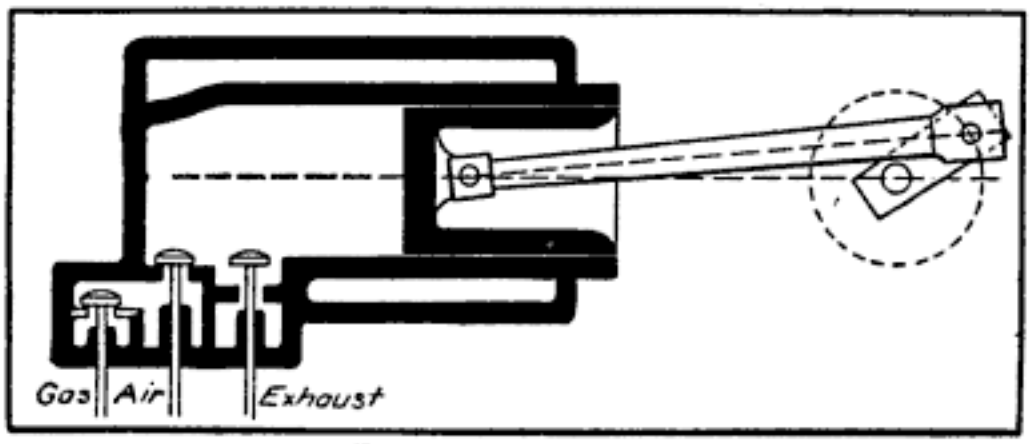
PREPARING TIN ROOFS FOR PAINT

When painting a new tin roof examine it first to see whether the tinner has used rosin or acid in soldering and left some of either on the roof. Rosin may be scraped off with a knife and acid must be cleaned off by rubbing the seams in the tin with kerosene oil and then washing with soapsuds and rinsing with clean water. For new tin that feels greasy, apply a wash made of 1 lb. of sal-soda in 6 qt. of water. Let stand one-half day, then wash tin with clear water. The paint will not scale off when this is done.—Grinnell's Handbook on Painting.

STARTING THE GAS ENGINE

In stopping a gas engine, after the gas is turned off the engine makes several revolutions, during which time it is drawing in air alone. This is what causes the trouble often experienced in starting up again, says the American Telephone Journal. The gas, when turned on, becomes diluted with the air already in the cylinder, as well as drawing air in with it.

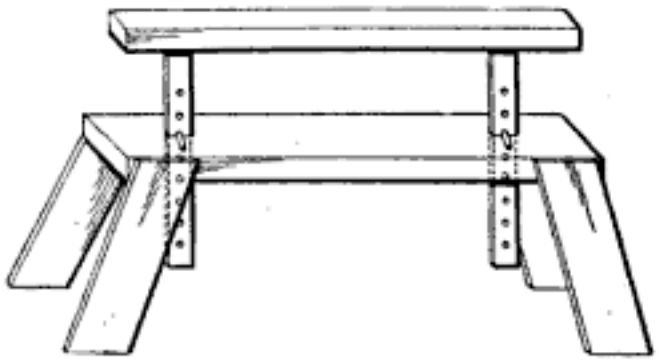
To save trouble, under these conditions, before starting up turn the flywheel until the exhaust valve is wide open and leave the valve in this position until the burned mixture has had time to escape. Moving the piston back and forth several times will facilitate matters, also. Then, with the exhaust open as in the diagram, start the engine, and there will be no difficulty in getting it to go.



Exhaust Open to Start

AN ADJUSTABLE HORSE FOR PAINT SHOPS

A pair of adjustable horses, like the one shown in the illustration, will be found convenient in many shops, says the American Artisan, but especially in car-painting shops. A plank should be laid across to form the staging. The construction is explained by the sketch.



Adjustable Horse

PORK RINDS FOR PACKING

I have been an oil pumper in the Indiana oil fields for a number of years, and have had considerable experience, as well as trouble, with different kinds of stuffing-box packing, old polish rods and worn-out stuffing-boxes. I find that the best and cheapest packing that can be used in water wells, a packing that will never get hard and bind in the box, nor wear the polish rod, is common pork rinds.

Cut them in strips about ½ in. wide, or use them just as they are cut from the meat. Pack by winding them around the polish rod till the box is full.

If the box is worn much in the bottom, it is well to put in a bit of hemp or prepared packing first, to prevent the rinds from working past the rod into the well. Just try it once.—Contributed by Bert P. Fleming, Petroleum, Ind.

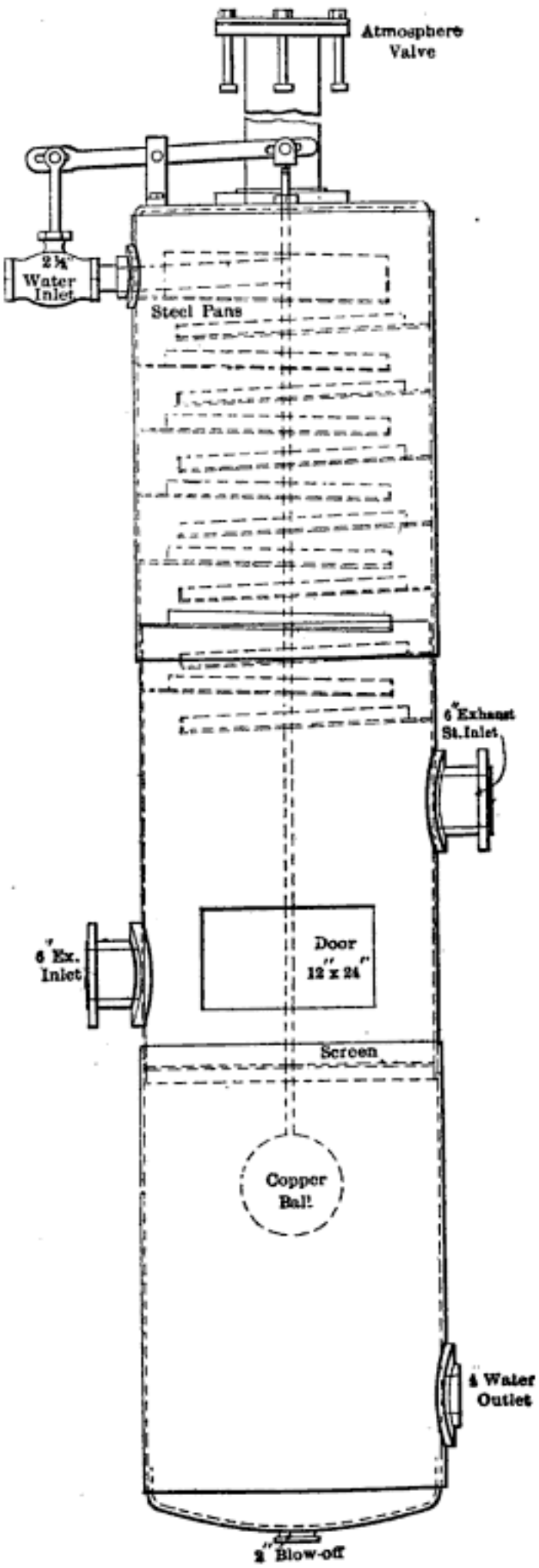
TO EXTERMINATE ANTS

Make a hole about 18 in. deep in the ant hill by pushing down into it a stick. Into the hole pour a wineglassful of carbon disulphide. The liquid is highly inflammable, more so than gasoline, and has a disagreeable odor, but it kills the ants.—Contributed by Henry K. Edgerton, Oconomowoc, Wis.

LABELING PASTE FOR TIN

Use flour and water to make a stiff paste and add 2 oz. of tartaric acid and 1 pt. molasses. Boil till stiff, then add 10 or 12 drops of carbolic acid.

A HOME-MADE FEED-WATER HEATER



Home-Made Feed-Water Heater

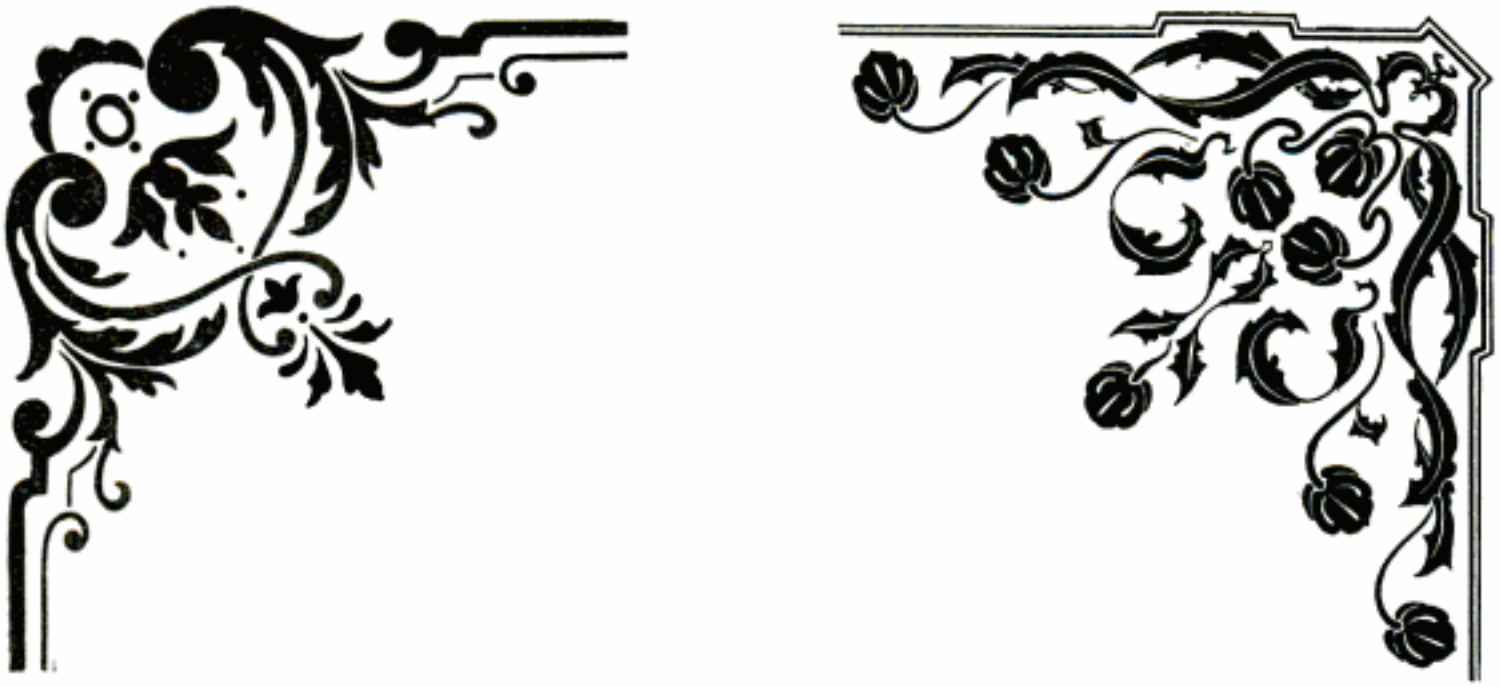
In boiler plants where the system of heating feed water is unsatisfactory, a home-made feed-water heater utilizing the heat from the exhaust steam may be substituted with a great increase of efficiency. A correspondent of Power tells how such a heater was made for a plant where feed water had formerly been heated in coils placed in the stack foundations. The chief steam consumer was a large compressor located just outside the boiler house and the exhaust from this compressor and the feed pump was sufficient to bring the feed water up to the desired temperature.

To make the heater a three-ring section of an old boiler, each sheet or ring being 4 ft. long was utilized. One end of this section had a dished sheet steel head and the other end was fitted in like manner. The heater was to stand upright so an 8-in. hole and an 8-in. tapped flange were put in the center of the top head as an exhaust vent or outlet. Into the flange was screwed a piece of 8-in. gas pipe, long enough to extend through the roof and a "clack" or atmospheric valve was placed on top of the pipe (see sketch).

Into one side of the boiler section at the top was run a 2½-in. nipple plugged at one end. This carried the water into the heater, delivering it through 50 or more ¼-in. holes drilled in the lower half from which the water dropped upon a series of fourteen pans arranged consecutively, as shown.

The lowest of these pans was just above the middle of the heater, and the exhaust was run in at about the middle, and here, also, was placed a door 12 by 24 in. Just below the door was placed an old fine-mesh screen to prevent foreign substances from reaching the pump. The outlet to the pump was placed 10 in. above the bottom, and in the center of the bottom was put a 2-in. blow-off which is opened daily to get rid of any deposit. A copper-ball float, attached by a reach rod through a small brass bushed hole in the top operated a lever which controlled the regulating valve and kept the water level just below the screen. A double-ported regulating valve was used—being substituted for a 2½-in. gate valve formerly tried, but which did not give good service.

This heater is self-regulating, and reliable. It takes the mud out of the water, and the average temperature maintained is 204° Fahr. The total cost of the heater in place was just $155.

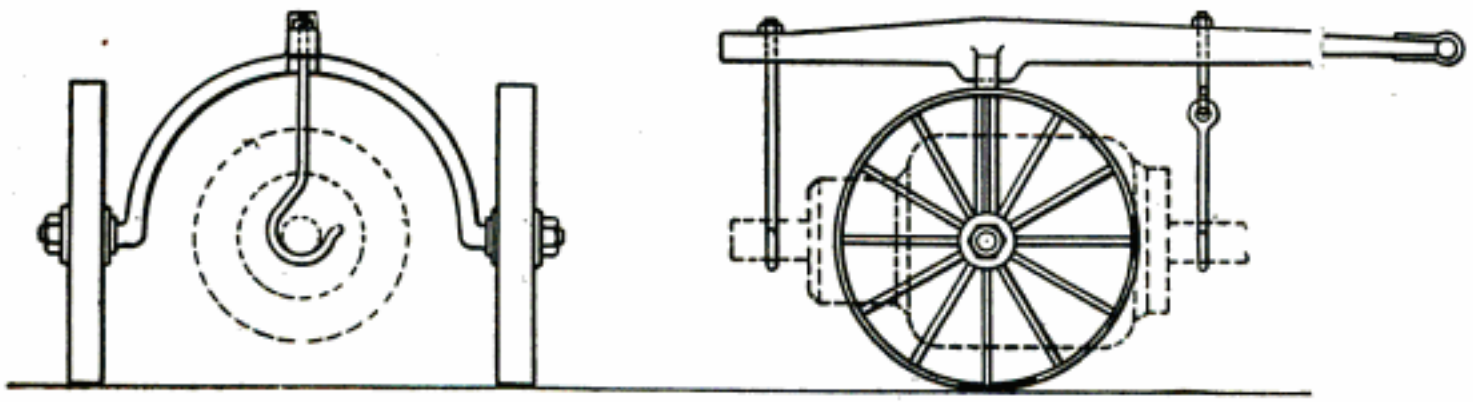


Corner and Frieze Designs from Decorators' Magazine, London

CONVENIENT ARMATURE CARRIAGE

This device which was built by the master mechanic of the Union Electric Co., Dubuque, Ia., is described in the Street Railway Review as follows:

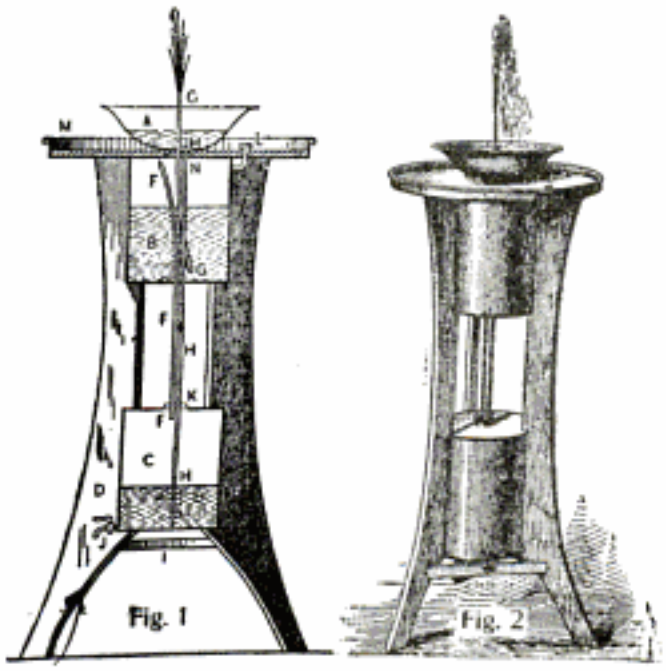
An arched bar terminates in journals on which are mounted the wheels, the radius of the arch being great enough to let the buggy run over any of the armatures used. To the top of the arch is fastened rigidly a long bar which is the longitudinal member of the buggy. For supporting the armature, there are two rods depending from the straight bar, each having a hook at the lower end. One of these rods is rigidly fastened to the long bar, while the other is attached to an eyebolt and is free to swing.



HOW TO MAKE A SHOW WINDOW FOUNTAIN

A fountain that will throw a stream 12 in. high for six hours and which can then be started again, using the same water, is very simple in principle and construction and makes an attractive feature for a show window. The fountain may be constructed entirely of sheet metal, or may have wooden supports, says the Metal Worker. The one illustrated here has the wooden supports.

Fig. 1 shows the details of construction. To make the bodies of the reservoirs B and C, procure a sheet of roofing tin 20x28 in., cut into two pieces 10x28 in. and bend to shape. Form the tin tubes H, H, F, F, G, G on a gutter beader and solder them perfectly tight. Use an ordinary 12-in. wash basin for the part A, and make a 2-in. hole in the bottom of it, under which screw a 1½ in. can screw top, N. Adjust the overflow pipe H so that it extends through a hole in the can screw under the basin through reservoir B, to within ¼ in. of the bottom of reservoir C. Arrange tube F to extend from within ¼ in. of the top of reservoir B through reservoir B, through can screw K, into reservoir C for ¼ in. Have tube G, from within ¼ in. of the bottom of reservoir B, extend upward through can screw N, and



end in a nozzle even with the top of the basin. At L insert a 1-in. tube, fitted with a small screw can top, for filling the upper reservoir. Use leather washers with can screws and make all joints and seams airtight.

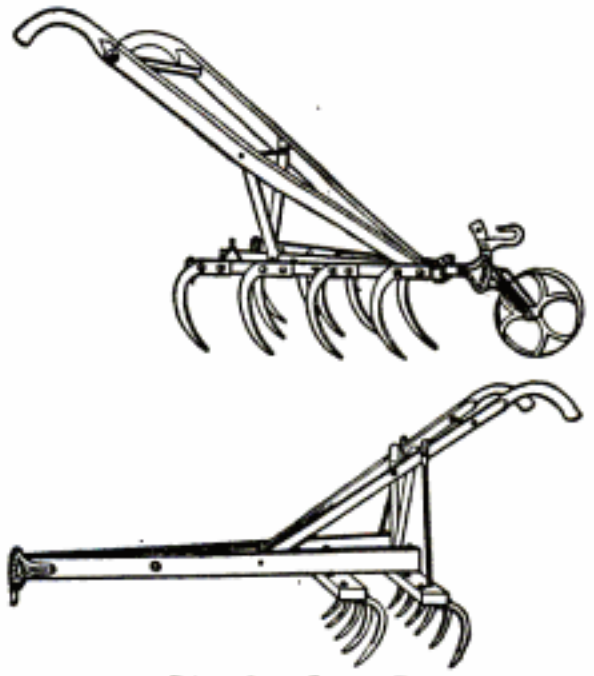
Make a circular top, M, with a wired tin rim 1 in. high. Shape the three wooden legs as illustrated and mount the reservoir within. The circular top, M, will serve as a flower stand in decorating. The fountain is now ready to operate.

Fill reservoir B through tube L with water, screw top on L, tightly, and fill the basin with water. The water will pass through tube H, force the air through tube F to the top of reservoir B and the pressure so created will force the water from reservoir B up tube G to spout out at the top in a tiny fountain. The falling water is carried from the basin by tube H to reservoir C until this reservoir contains all the water. Then the water may be drawn off at faucet J, and the upper reservoir refilled.

The nozzle for the tube G may be made of a hollow nickel stove knob and a small screw can punctured at the top with a hole not larger than a common sewing needle. The reservoirs can be larger if desired.

MACHINE FOR DIGGING GRASS ROOTS

The Department of Agriculture gives details of two handy machines for digging grass roots. These machines are very effective and can be rigged out at any blacksmith shop by taking a cultivator frame and making the teeth required as shown in the cut.



Digs Out Grass Roots

Last year this country mined 27,664,330 long tons of iron ore which was a decrease of over 7,000,000 tons over the previous year.

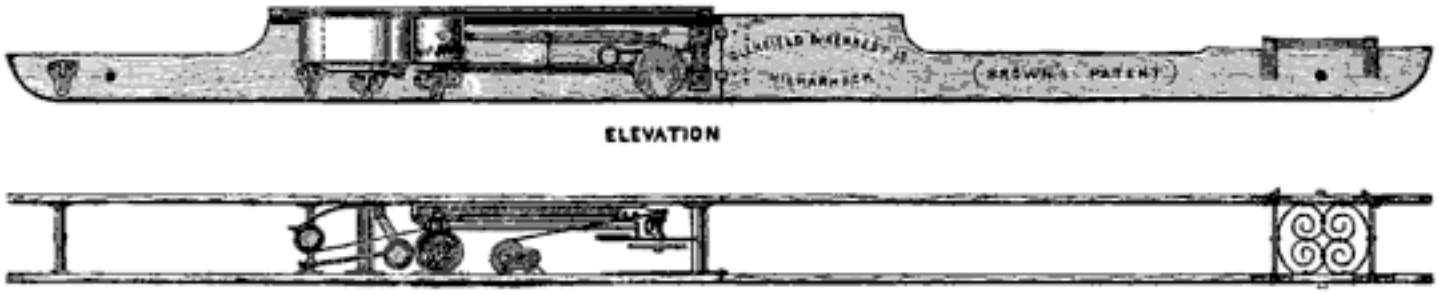
The "Virginian," the new Allan turbine steamship, broke the record for trans-Atlantic trips from land to land by 20 hours recently. The vessel's time was 100 hours.

THE VIAGRAPH AND HOW IT WORKS

The viagraph is an instrument which, when drawn along over the surface of a road, furnishes an exact profile of the road surface, showing its elevations and inclines with accurate measurements as to the locality and amount of any unevenness. It was invented by John Brown, of Ireland, and was first tried on the Belfast and Lisbon road in 1898. America, notorious for having the worst roads in the world, has given little attention to the viagraph or any other invention that would aid in the establishment of good roads. The Motor News, of Dublin, says:

The viagraph is in principle a straight edge applied continuously to the road surface, along which it may be drawn for (first) recording on paper a profile of the road surface, and (second) indicating a numerical index of the unevenness of the surface.

A lever, pivoted to the main frame, carries on its free end a serrated wheel, near the middle of the apparatus. While the main frame in being drawn along the road preserves a sufficiently even line, this road wheel rises and falls over all the unevennesses of the surfaces, carrying with it the lever and thereby transmitting its movements by means of a link to a second lever carrying a pencil, which marks the full amplitude of these motions on the paper passing round the drum. While the motion of the pencil takes place in a vertical direction, the paper on which it marks is carried under it by the drum, which is rotated by a worm and wheel below it, connected by a shaft and bevel gear with the road wheel. The result is a profile of the road gear surface, of which the scale is full size vertically, and ⅛ inch to one foot longitudinally. A second pencil draws a datum line corresponding to that which the indicating pencil would produce from a perfectly even road. From this can be measured the depths of the ruts or "cups" or other unevennesses indicated on the diagram. Each descent of the road wheel into a rut or cup causes this counter to register the amount of the drop, the reading being given in feet per mile of road. The distance is measured off automatically by an ingenious mechanical arrangement which rings a bell when the 88 yards have been traversed.



ELEVATION

PLAN

The Viagraph

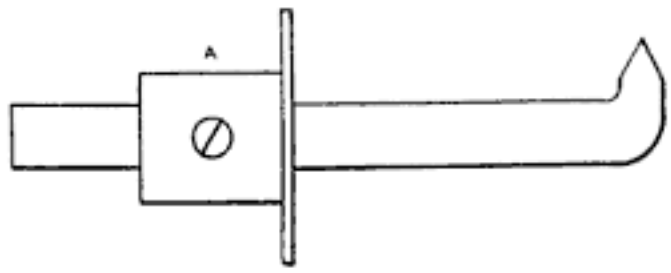
HOW TO CLEAN TRACINGS

Tracings that are badly soiled with grease spots or other dirt may be nicely cleaned with kerosene. Tack the tracing to a board and apply the kerosene gently, but liberally, to the surface, allowing it to soak a short time, and then drying off with a clean rag. Turn the tracing over and treat the other side in the same manner. Dry it on the radiator; it can be safely done. The polish will not be removed from either side of the tracing

A HANDY GLASS CUTTER

A device for cutting off gage glasses, which works almost as good as a first class diamond, is made of a piece of round ¼-in. tool steel, says a correspondent of the Engineers' Review.

Bend the steel and bring to a sharp point as shown in the illustration and then temper in oil. Make a gage collar as at A, with a projection at one end to more than



Water Glass Cutter

cover the end of the glass. Hold the gage in place with a screw.

To use the device with a glass, let us say, ½ in. longer than required, slip the gage, A, up on the cutter till ½ in. from the cutting point and turn the instrument around in the glass.

HOW TO BUILD AN OVERSHOT WATER WHEEL

In building a water wheel, the "overshot" wheel, or one taking water at the top, is the most powerful, the cheapest, and best adapted to ordinary requirements. The construction of an overshot wheel is very simple, though each individual builder must proportion its size to the fall of water available to him, and the amount of power he desires to obtain.

A 15-ft. fall would require a wheel about

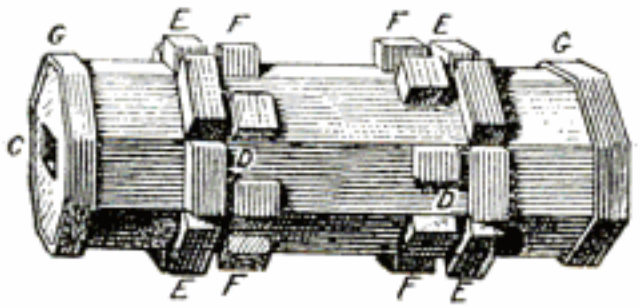


Fig. 1

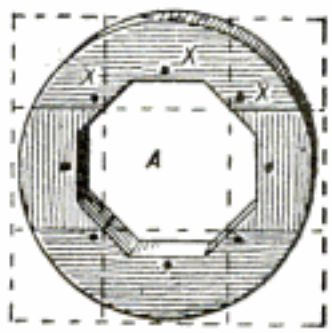


Fig. 2

10 ft. in diameter, and the space between the buckets must be equal in order to keep up a steady motion, while each person must adapt the depth of the buckets to the volume of the water. Hardwood should be used for the whole structure. Oak is the best wood for the purpose, but if this cannot be obtained, hard rock ash or hard rock maple may be used for the more important parts.

The first part to make is the shaft, Fig. 1;

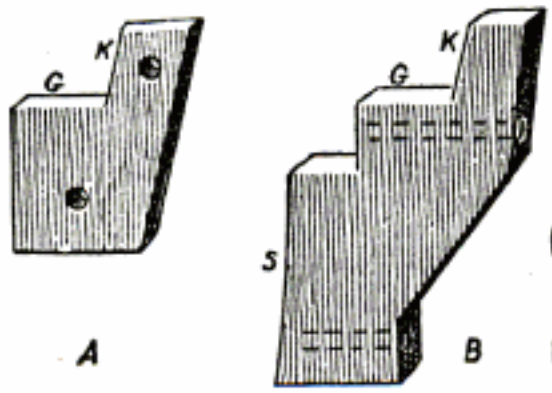


Fig. 4

make this with eight sides and with a square hole in the ends, as at C, for the "gudgeons" or journal pieces. Fasten these pieces in the shaft by means of bolts passed through holes at D D. Near the ends of the shaft, fasten by wooden dowels, blocks, as at E, E, etc., and just within these blocks place other blocks, F, F, etc., fastened by dowels also; the blocks on one end being on opposite edges of the planes of the shaft to those of the other. These smaller blocks are for the purpose of securing the feet of the diagonal braces, which assist in holding the spokes of the wheel upright; they are placed on opposite edges of the planes to permit the stays to cross without interfering. To prevent the shaft's splitting, place an iron band, G, 2 in. or more wide and ½ in. or more thick on each end, and secure each band with four lag screws on alternate planes. A shaft from 18 to 24 in. long is of a good size. The use of wooden dowels is better than spiking for fastening blocks, etc., says a correspondent of the Blacksmith and Wheelwright, as the dowels swell and shrink with the wood of other parts and give off no rust.

To make the hubs, Fig. 2, of which there should be an inner and an outer one for each end of the shaft, frame each of them together in four pieces in the form of a square as shown by the dotted lines in Fig. 2, and cut the hole the proper size for adjusting on the shaft. The hubs may be left square or rounded off, as desired. Make holes as at X, X, X, etc., for securing the spokes to the face. Place the inner hubs on the shaft first and secure them to the blocks, E, by means of dowels at the holes, X.

Fasten the spokes, C, C, C, Fig. 3, to the inner hub and then put on the outer hub (A, Fig. 3), and fasten it at X, X, X, etc., to the spokes and inner hub. The outer rim (D, Fig. 3), may now be put on. This rim should be deep enough to form the outer ends of the buckets. In the inner rim,

E, the outer periphery equals the inner periphery of the outer rim, D, and this inner rim is used to fasten the sheathing, T, which forms the bottoms of the buckets, to. Fasten the inner rim, E, in place on the wheel and sheath it with tongue and grooved hardwood pieces 1½ in. or more thick, and doweled in place. Fasten on cleats (F, F, F, etc., Fig. 3), running all the way across and secure them to sheathing with dowels.

A section of a bucket is shown at G, K. Fasten the bottom of the bucket, G, to the cleats, F, and the outer web, K, of the bucket, to the rim, D, and the inside web or bottom, F. An iron band, L, on the outer rim and covering the outer web of the bucket one inch, may be used as an additional security, if desired. Blocks for supporting buckets are shown in Fig. 4. The form of block at A may be fastened to the inner side of the rim; the one at B may be used at the center. The surfaces, G and K, would support the webs of the bucket marked G and K in Fig. 3. To conform with the sheathing, the side, S, of the block, B, is cut with a sweep. Fig. 3 shows such blocks in position at N and P.

The diagonal stays for supporting the spokes are shown in the sectional view at Fig. 3. M is the shaft, C the spoke, and J the stay from shaft to spoke. In Fig. 4, at C is shown the gudgeon pin or journal. The square part, T, is let into the end of the shaft and is held by the bolt passing through the shaft and gudgeon at R. The iron should be at least 2½ in. in diameter. Secure short posts to the "mill" posts outside and then secure a transverse piece into which to fasten the boxes. Oil may be fed through a metal tube from the top.

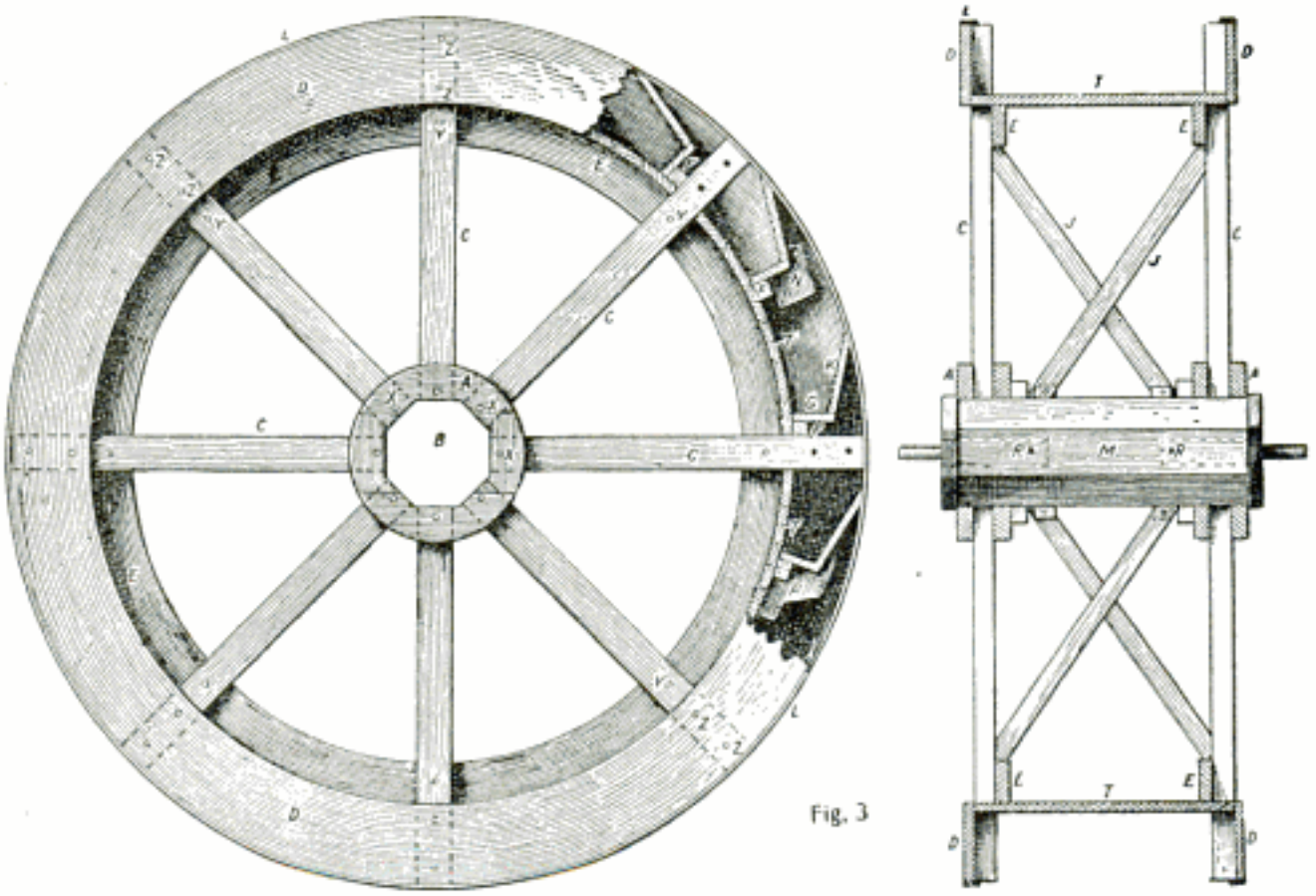


Fig. 3

For transmitting the power of the wheel, fasten a gear wheel to one end of the shaft outside the spokes. Probably the best means is to secure an eccentric disk or wheel to the end of the shaft and use a wooden pitman or connecting rod to apply to the machinery above. The power developed by such a wheel depends on the volume and fall of the water.

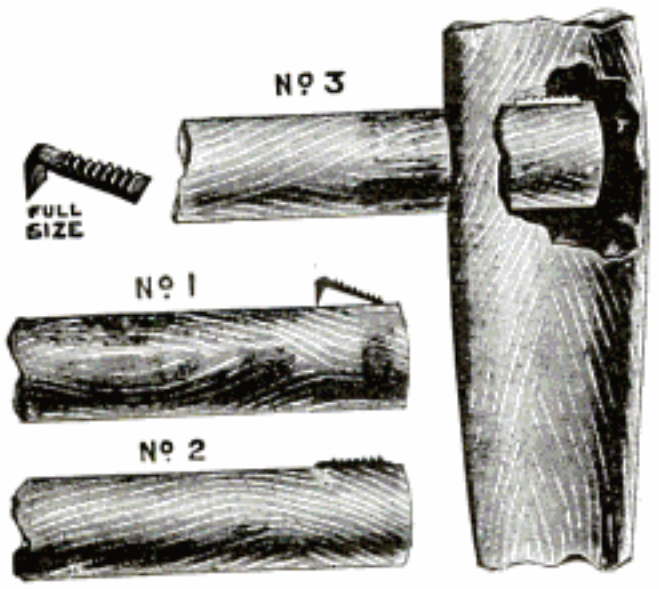
FILLER FOR HARDWOOD

Make a very thick paste of boiled linseed oil and powdered starch; add a little japan and then with oil of turpentine reduce to working consistency. For dark ash and chestnut, add a little raw sienna, says the Master Painter; for walnut, add burnt umber and a little Venetian red. For white oak or white ash no color is required; for other woods, use enough color to cover the white of the starch. Apply with a brush or rag; let stand a few days, then sandpaper.

A grease spot on wood can be removed by using a saltpeter or a thin lime wash, then rinsing with clear water. If necessary, repeat the process.

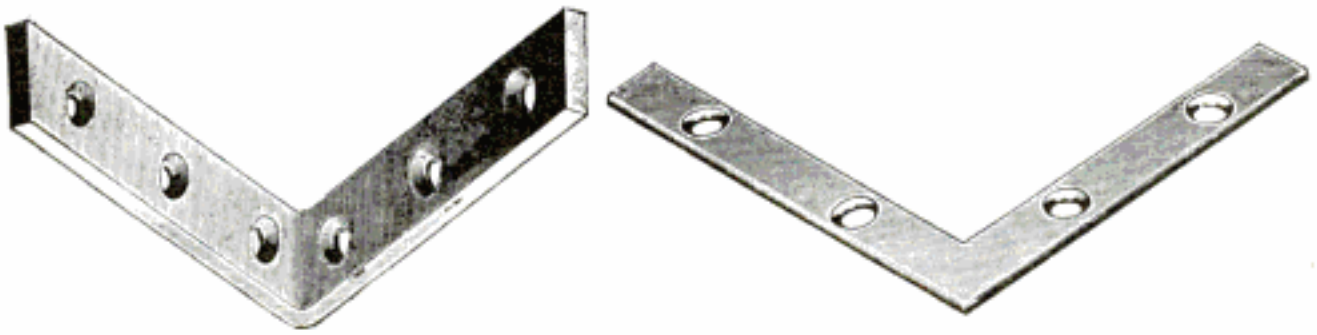
REPAIRING CHAIRS

For repairing chairs and other light articles of furniture, there are several little devices that may be purchased at the hardware store more cheaply than they can be made and thus insure a neater job.



The Dowel Fastener

Among these, says the Furniture Journal, is the dowel fastener, a small barbed piece of steel which is driven in beside the dowel pin and prevents its coming out. Mending plates of steel with countersunk holes are convenient, also, and for holding legs in chairs a piece of steel with a sharp point for driving into the chair leg and a screw hole to fasten it to the seat of the chair is provided. There are various sizes and shapes of corner irons for strengthening weak places.



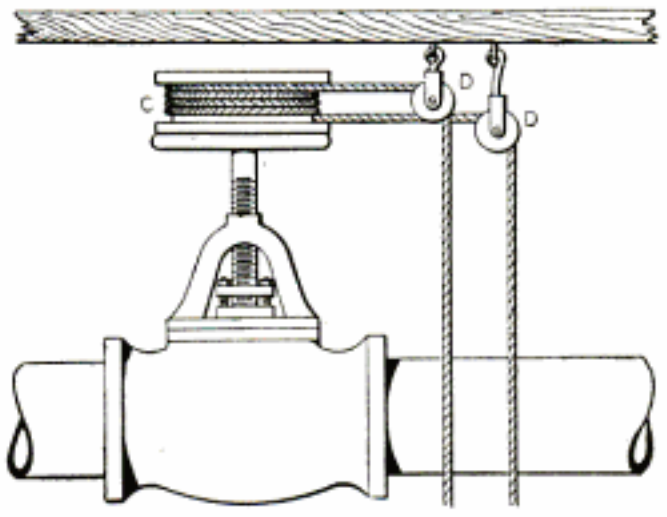
Corner Irons for Bracing Chair Legs

PASTE THAT WILL NOT SOUR

A paste that will not sour, says a correspondent of the Master Painter, is composed of 3 qt. flour, 3 teaspoonfuls powdered alum and ½ teaspoonful powdered blue vitriol. Mix in dry state and make in the usual way. Safe to make up a barrel of this paste at a time.

VALVE OPENING AND CLOSING DEVICE

A valve that had to be opened several times every day was very difficult to get at, being in the position shown in the sketch. A correspondent of the Engineers' Review tells how he rigged up a device by which the valve could be opened or closed without climbing up to it on a ladder.



Valve Opening and Closing Device

A wooden wheel, flanged, was turned and bolted to the valve wheel, as at C, with ¼-in. bolts, having the heads cut off and bent in the shape of a hook, in order to lap around the arms of the valve wheel. A length of ⅜-in. rope was wound around the wooden wheel, giving it enough turns to open or close the valve without having the rope bring upon the part of the valve to which the pulley was fastened. Small pulleys, D, D, were suspended from the beam by screws and the rope passed over these, as shown, to bring it down within easy reach and prevent its running off the pulley. An endless rope was used and by pulling one way or another on it the valve can be opened or closed as desired.

ANOTHER AUTOMATIC FURNACE TENDER

As nearly all furnaces have a lever, B, Fig. 1, to close the draft and open the check when the steam reaches the point set for, Fig. 1 will be easily understood.

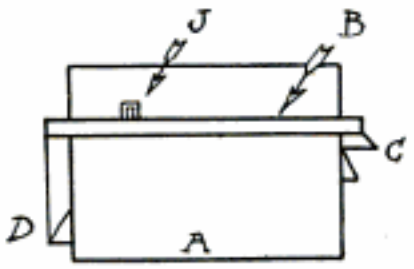


Fig. 1

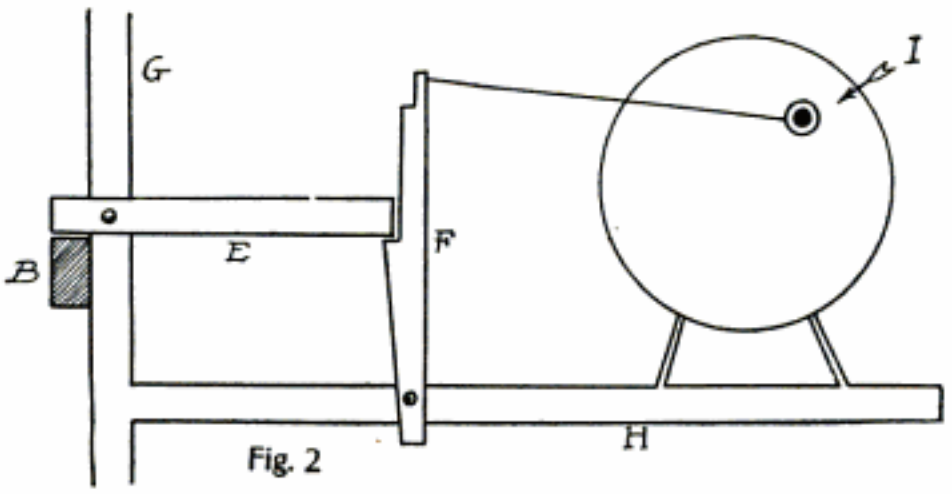


Fig. 2

The arrangement in Fig. 2 is intended to be placed at about the point J in Fig. 1. It consists of an upright 1 in. by 3 in., having a shelf H, on which the clock is to be set, nailed to it. The levers, E and F, are both of band iron, though wood could be used if preferred. A slit is sawed in a small spool, so it can be pushed on the alarm wind and the apparatus is then set as indicated, the lever B being placed under the outer end of F, the alarm set for the time desired, and a small string run from F to the spool on the alarm at I. When the alarm goes off, the string pulls F from E and E falls to a perpendicular position releasing B, thus closing check. This device can be rigged up in two hours, is simple and one can always be sure of a fire.—Contributed by H. E. Gregory, Waverly, N. Y.

WATERPROOF CEMENT RECIPES

1. White lead, red lead and boiled oil mixed together with a good size to the consistency of putty.

2. Dissolve 1 oz. powdered resin in 10 oz. strong ammonia and add 5 parts gelatine and a 1-part solution of acid chromate of lime.

3. For a waterproof paste cement, add to hot starch paste one-half its weight of turpentine and a small piece of alum.

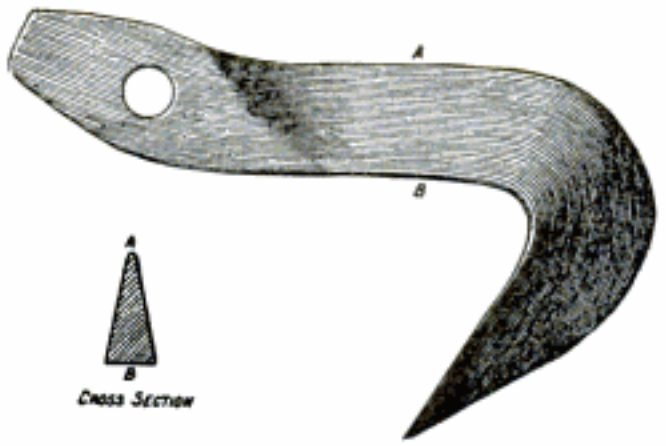
4. For lining cisterns, make into a paste with boiled oil, 2 parts each of powdered brick, quicklime and wood ashes.

TO SOFTEN DRIED PUTTY

Putty that has dried hard as rock can be softened as follows: Pound it with a common hammer on a smooth, hard surface, add a little linseed oil and it can then be worked with the hands easily and will be as good as when fresh.—Contributed by H. N. Pond, Topeka, Kan.

FORGING A LUMBER DOG

The lumber dog shown in the sketch is made of steel ⅞x2x13 in., punched at one end and drawn out as if for sharpening a chisel. It is then bent about two-thirds of the way round and the back drawn down



Forging a Lumber Dog

as thin as possible, but still leaving the point full width of the steel, or ⅞ in. This kind of dog is commonly used in Oregon, says a correspondent of the Blacksmith and Wheelwright.

TO DEODORIZE BENZINE

To 1 gal. benzine add 3 oz. quicklime. Shake well; let lime settle; pour off and filter the benzine.

AN AIR-BOUND PIPE LINE

Some time ago I laid a line of 4-in. pipe about 3,000 ft. long, says a correspondent of Power. The first 1,000 ft. gave me a fall of 530 ft.; the rest of it was comparatively level. As the pressure was not required and some of the pipe not very good, I did not put in any valve, but piped direct to a tank having a large enough overflow to take care of any excess in case of the mill shutting down. When everything was completed, the water was turned in, and after waiting some time we were somewhat surprised that no water came to the mill. I had had a similar experience before, but never when there had been so much pressure, and was inclined to think something had gotten into the pipe. However, I took a sharp pick and hunted the high places. When I found one very prominent, I stuck the pick into it. After finding about a dozen of them, the water came all right. I have since lowered the high places when possible, and put in petcocks where I could not level the pipe, and have had no more trouble.

STEAMING OUT SPLINTERS

When a splinter has been driven into the hand it can be extracted by steam. Fill a wide-mouthed bottle nearly full of hot water, place the injured part over the mouth and press it slightly. The action thus produced will draw the flesh down, and in a minute or two the steam will extract the splinter, also the inflammation. Try it and be convinced.—National Magazine for June.

HOW TO RESPOKE A METAL WHEEL

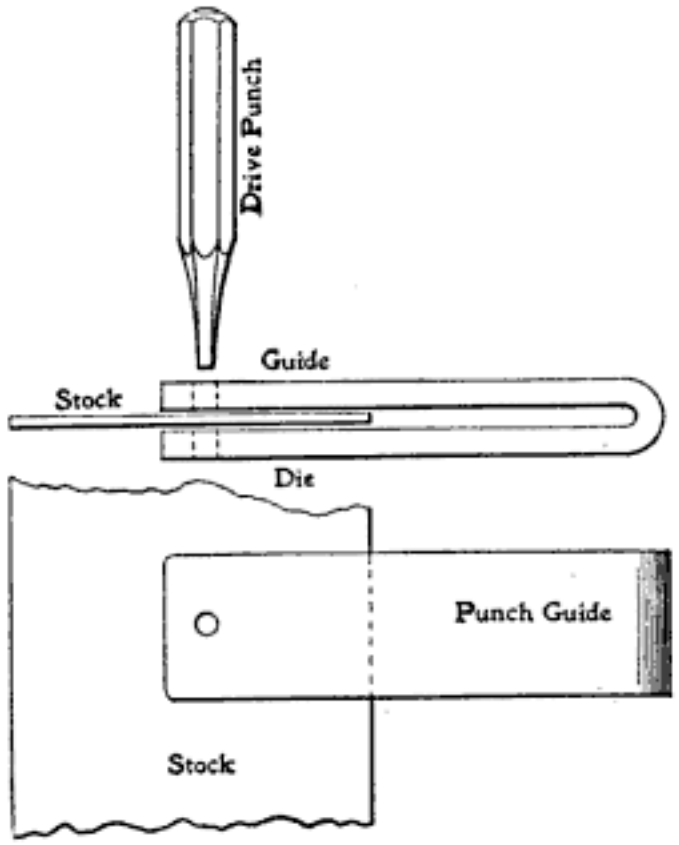
For a threshing machine wheel, ⅝-in. iron rod is the stock to use. Cut the spokes ½-in. longer than the required length and upset them in the hub, marking each one so it will be put in the right place. Cut threads at the outer ends of the spokes and use jam-nuts.

Drive the spokes in the hub and true up the wheel with jam-nuts, tapping the spokes in the meantime. When true, head the spokes and see that all the nuts are tight. A correspondent of the American Blacksmith says he respoked a wheel of a 50,000-lb. threshing machine in this way four years ago and that it is solid yet.

Spokes can be removed from buggy wheels by the following method: Place the spoke in the vise with the inside of the wheel up; place a short block of wood against the hub above the spoke and strike with a 6-lb. sledge. One blow will bring it. A piece of felt will protect the paint.

HAND PUNCH FOR SHEET METAL

This device for punching holes in sheet metal is extremely simple and will be found a great convenience to those who possess no punching machine, says a correspondent of the American Machinist. The guide con-



Convenient Hand Punch

sists of a bit of steel doubled over with a free hole drilled through the ends. The illustration is self-explanatory.

That device that saved you so much trouble the other day would help your brother mechanic, if he but knew about it. Send us a sketch and brief description.

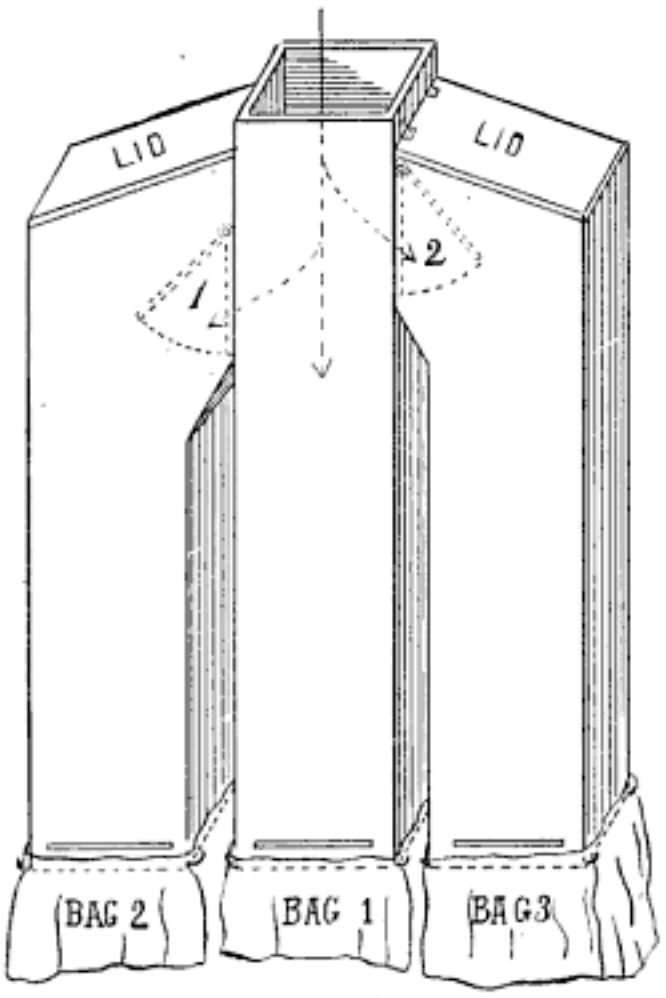
A blueprint is ready for washing when a slightly moistened finger touched to it, leaves a mark nearly purple.

Coal containing a large amount of carbon gives the best heat; the oxygen being combined with hydrogen as water is of no value. An excess of hydrogen in gas coals, however, is an important item in the production of heat.

HOW TO MAKE AN AUTOMATIC BAGGER

The sketch shows an automatic bagger for elevators and mills that will fill three bags in succession without attendance. The device is very simple in construction and works as follows:

The stock falling through the central



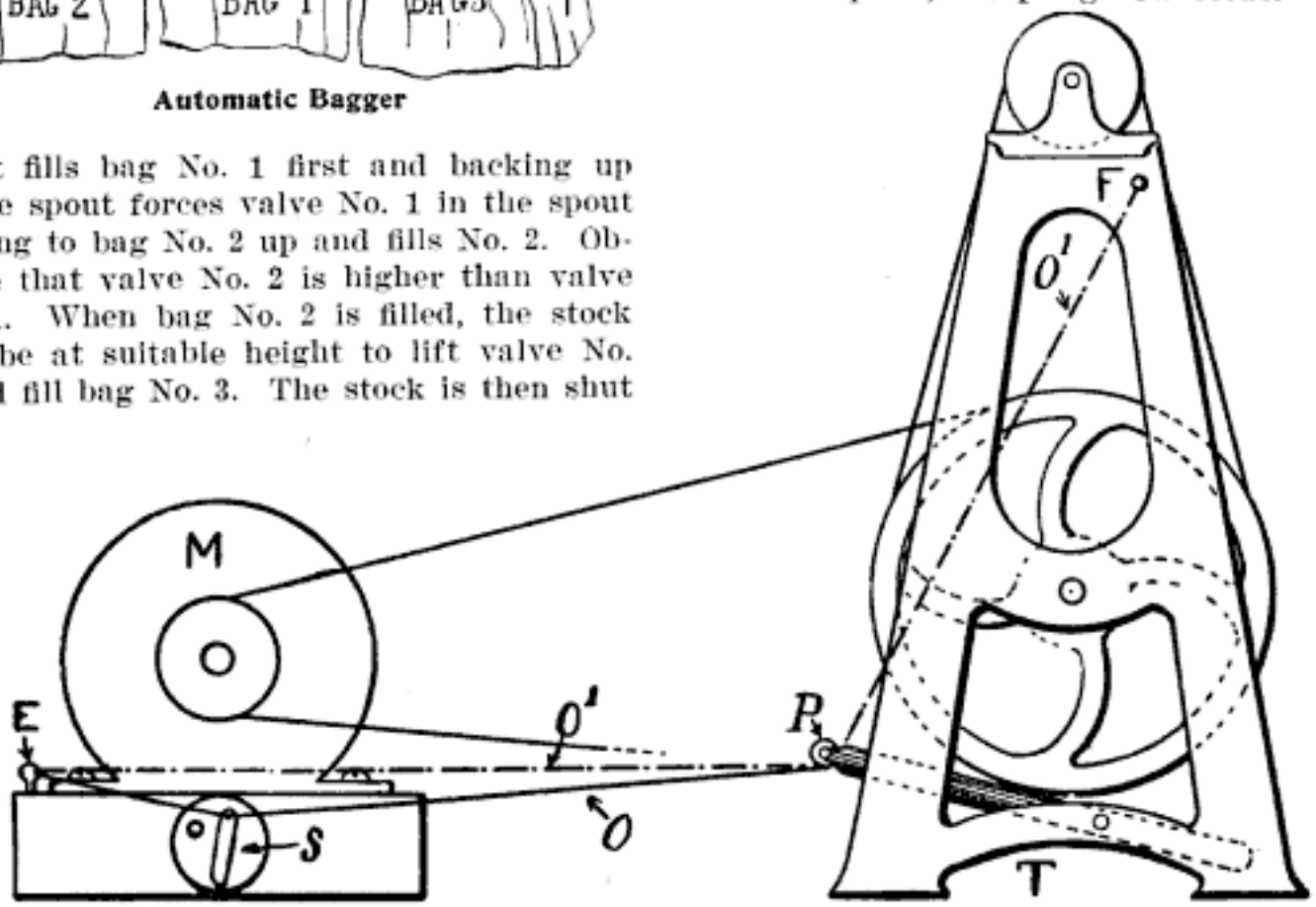
Automatic Bagger

spout fills bag No. 1 first and backing up in the spout forces valve No. 1 in the spout leading to bag No. 2 up and fills No. 2. Observe that valve No. 2 is higher than valve No. 1. When bag No. 2 is filled, the stock will be at suitable height to lift valve No. 2 and fill bag No. 3. The stock is then shut off and empty bags replaced for the filled ones.—Contributed by F. S. Cummings, 289 Forsyth Ave., Detroit, Mich.

RUNNING THE LATHE WITH A MOTOR

The accompanying illustration shows how Eugene F. Tuttle, Jr., of Newark, Ohio, connected up a small footpower wood-turning lathe with a $\frac{1}{10}$-hp. electric motor. The lathe treadle, T, was disconnected from the flywheel, and the flywheel was then belted to the motor, M. On the base of the motor was mounted a one-point switch, S, which was connected up as indicated.

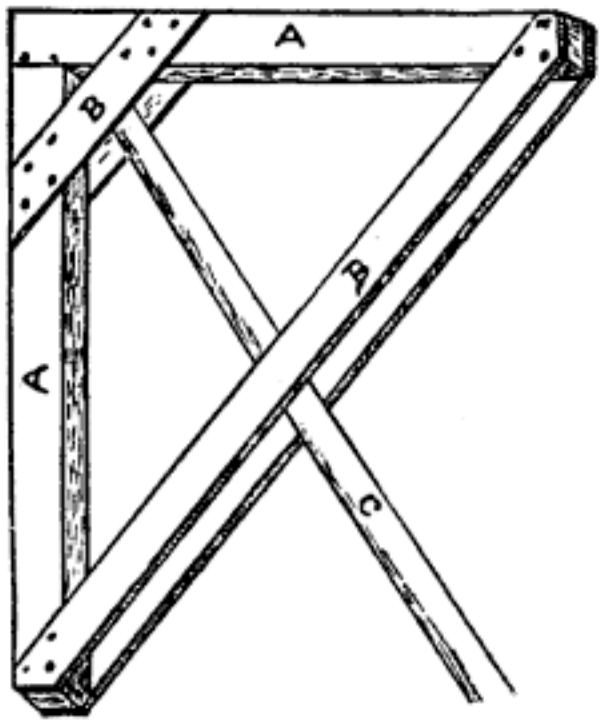
A small pulley, P, large enough to turn in the place where the driving rod works on the treadle, T, was made and put in place and a cord, O′, was run from the switch, S, through a screw-eye, E, under the pulley and up to the bed of the lathe, where it was fastened at F. When the front of the treadle is depressed it pulls on the cord, O′, and opens the switch. The switch is closed by another cord, O, running from the switch direct to the pulley where it is fastened at the side of the pulley. This string must be kept tight to give satisfactory results. The switch may be obtained of any electrical dealer and should have a 1½ or 2-in. spark gap when opened. The arrangement has been in use two years with no repairs, excepting new cords.



Motor Controller for Lathe

A HANDY SCAFFOLD BRACKET

In the scaffold bracket illustrated here, A A are pieces of 3x4; B B, pieces of inch board, and C is a long pole used to elevate the bracket to some high or difficultly

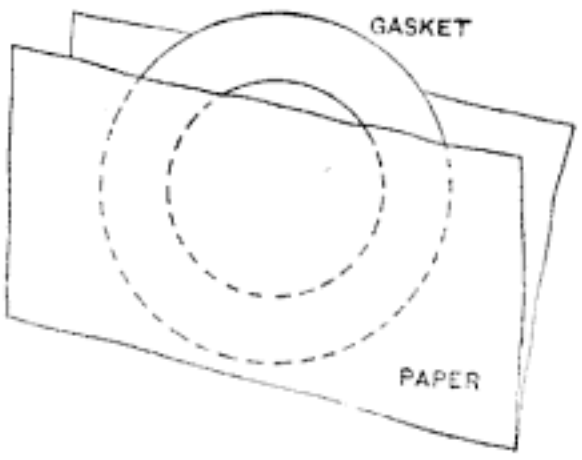


A Handy Scaffold Bracket

reached part of a building where it is to be used. The foot of the pole, says the Master Painter, may be secured by a stake driven into the ground. Two or three poles, with a board or more across, can be raised simultaneously and a safe scaffold is up ready for use.

HOW TO CUT AND APPLY GASKETS

There are a few simple kinks which, if observed in cutting and applying gaskets, will make the work much easier, says a correspondent of Machinery. While cutting the rubber, have a dish of water at hand and keep wetting the cutter. Excellent results may be obtained by this method on rubber gaskets 1 in. thick. A gasket



Method of Inserting Gasket

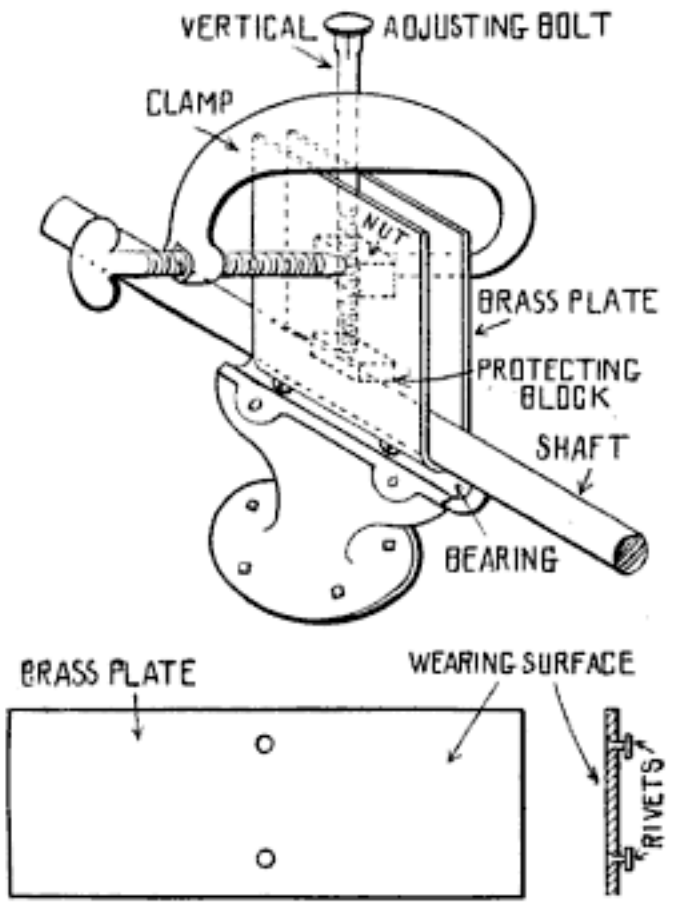
will be much more easily removed should the joint break, if the flanges are chalked at the time the gasket is put in place.

Where two flanges cannot be separated any great distance and there is trouble in inserting the gasket, place it between a folded sheet of paper as shown in the sketch, and it will go in more easily. After some of the bolts have been entered, tear out the paper.

BABBITT JOURNAL BOX KINK

A babbitt journal box with a brass wearing surface for either large or small shafts, may be made as follows:

Have the brass of suitable thickness and length for bending around the shaft, and at



Adjustable Journal Box

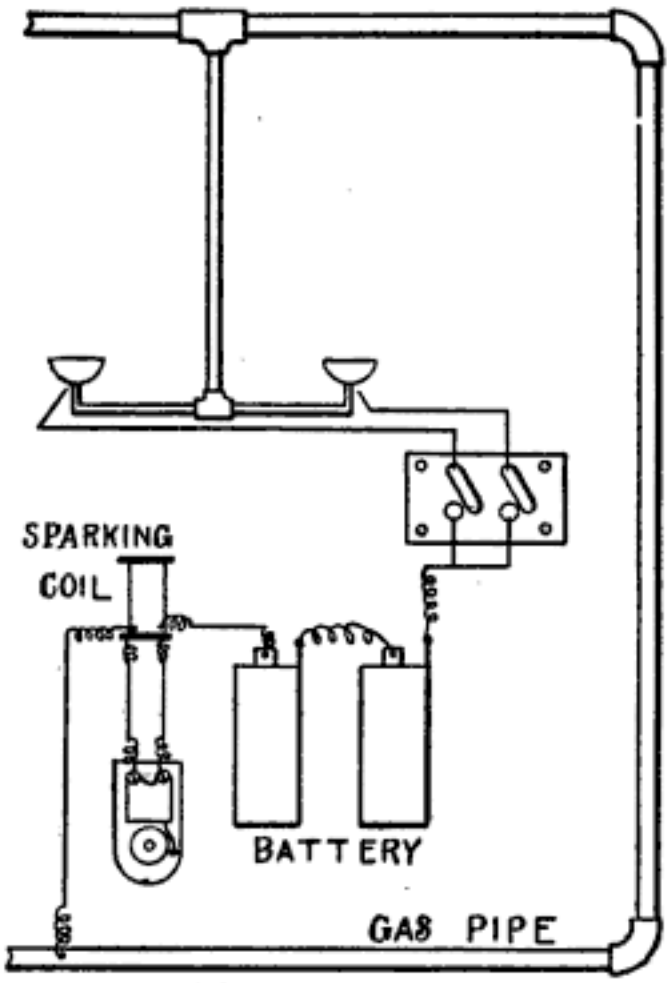
the center of the plate drill and countersink holes for soft metal rivets, having heads that project slightly, so the filling of metal can take hold. The countersink is for the small end of the rivet. Smooth down to fit shaft, and in case of rivets being too large, after bending follow up the dents near the rivets with gentle tapping.

Where the shaft can be had of suitable temperature the smooth plate can be treated in the usual way by soldering on the under side and near the rivets. After filling with the babbitt metal, let cool and then file off any surplus brass. Then, in case of

overheating, the rivets will hold the brass, if the heads project far enough. This box may not be suitable for all shafts, such as conical shapes, etc.—Contributed by August Rinne, 937 Alameda St., Los Angeles, Cal.

WANTS TROUBLE ALARM PLAN

The accompanying sketch is sent us by W. Williams, of 100 Stockton St., Brooklyn,



What's the Matter ?

N. Y., and is a plan of an electric gas-lighting system of five burners, which he has installed in his house. Mr. Williams wishes to know how to connect a bell with this system, so that, if there is any trouble on the line—a short circuit or a ground—the alarm will sound. Can any one offer a suggestion? With the wiring indicated the alarm worked for awhile, but finally stopped.

HOW TO MAKE GRAFTING WAX

A good grafting wax can be made by breaking up fine 4 parts resin and 2 parts beeswax and melting them with 1 part of tallow or linseed oil. When thoroughly melted, pour the liquid into a vessel of cold water. When it is hard enough to handle, take it out and pull and work it until it becomes tough and of the color of very light manila paper. The wax may be applied hot with a brush, says a bulletin of the Department of Agriculture, but care must be taken to avoid injury. If applied by hand, first grease the hands with tallow. Spread the wax over all cut or exposed surfaces and press closely, so that when cool it will form a coating impervious to air or moisture.

To make waxed string, put a ball of No. 18 knitting cotton into a kettle of melted grafting wax. In five minutes the cotton will be thoroughly saturated and will remain suitable for use indefinitely.

SHADE FOR ELECTRIC LIGHT

Procure a piece of tin of suitable size and strike out a circle on it about 8 or 10 in. in diameter, and a smaller circle 1½ in. in diameter in the center of the first circle, as shown in Fig. 1. Cut out the large circle with a pair of shears and cut an opening in it, as shown at A, Fig. 1.

Punch out the center circle by means of a punch and finish it round with a file. Fold the edges together and solder or rivet,

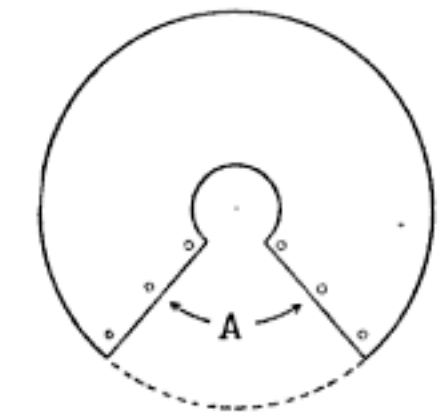


Fig. 1

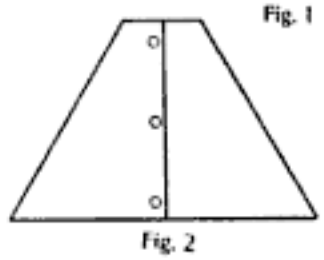


Fig. 2

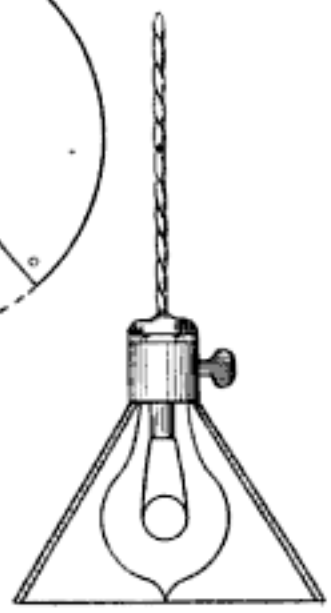
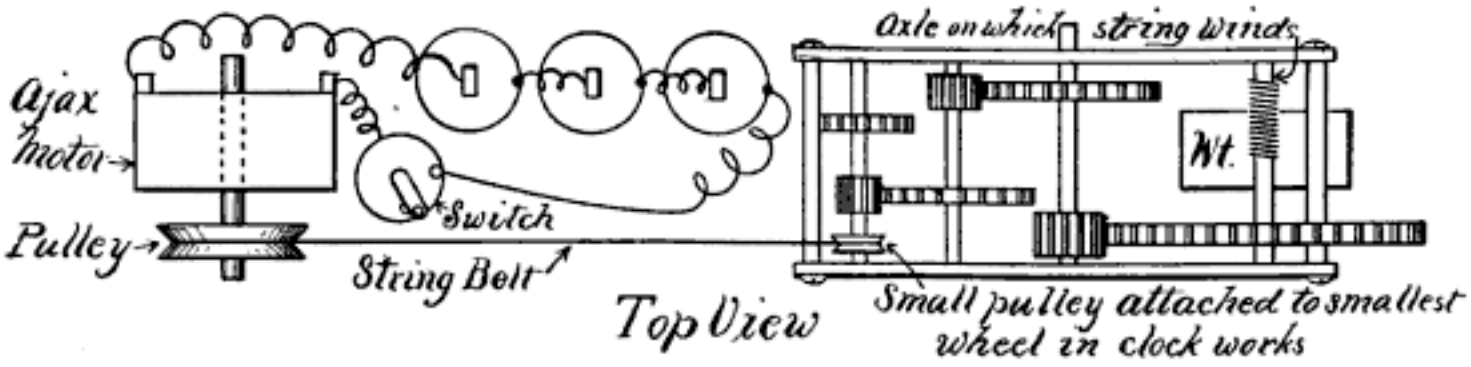


Fig. 3

as in Fig. 2. To adjust the shade to the lamp, put the lamp up inside the shade, so that the end that screws into the socket projects through the opening at the top and then screw the lamp into the socket. The large part of the lamp will prevent the shade from coming off (Fig. 3.) Such a shade is cheap, easy to make and answers all purposes. The exterior of the shade may be painted green if desired.—Contributed by W. J. Slattery, Emsworth, Pa.

MECHANICS FOR YOUNG AMERICA

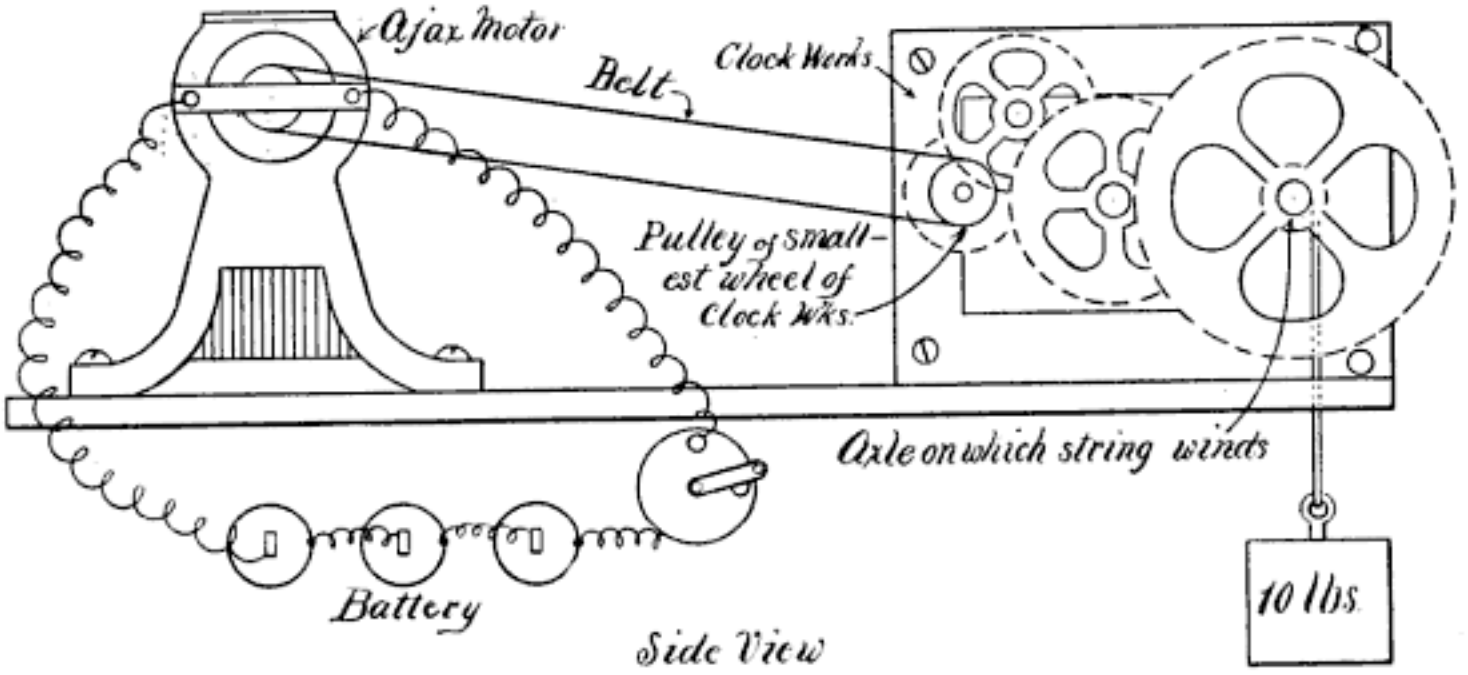
HOW TO MAKE A TOY BATTERY MOTOR LIFT A 10-LB. WEIGHT



The materials necessary are a small battery motor, three or four cells of batteries, an old clockwork, and a board about 12 in. long and 6 in. wide. Remove the mainspring from the clockwork and make a small pulley and fasten it on the axle of the smallest wheel in the mechanism.

Fasten the clockwork on one end of the board in such position that the large wheel will project over the edge. Place the motor on the board about 6 in. from the clockwork and connect the pulley of the motor with the pulley in the clockwork by a string belt. Now fasten a piece of strong cord or chalkline to the axle of the large wheel of the clockwork and put a weight of about 10 or 12 lb. on the end of the string.

Using three or four batteries, the motor will lift the weight up to the level of the clockwork without difficulty. This experiment demonstrates the power of gearing.—Contributed by W. J. Slattery, Emsworth, Pa.



TO RENEW OLD DRY BATTERIES

Remove the paper that covers the cell and knock several good-sized holes in the zinc shell. Place the battery in a glass jar, fill it two-thirds full of strong sal ammoniac (or salt) solution and connect the terminals to whatever apparatus the current is to be used for. A few drops of sulphuric acid quickens and improves the action. The output of the cell will be nearly as great as when the battery was first bought.—Contributed by C. W. Arbitt, Austin, Texas.

WEATHERPROOFING FOR TENTS

Dissolve 4 oz. sulphate of zinc in 10 gal. water; add ½ lb. sal-soda; stir well until dissolved, and add ½ oz. tartaric acid. Put the tent cover in this solution and let lie 24 hrs. Take out (do not wring it) and hang up to dry.—Grinnell's Hand Book on Painting.

HOW TO MAKE AN ELECTRIC FURNACE REGULATOR

We have a furnace in our house and a part of my work each evening last winter was to go down in the basement at 9 o'clock, fill the furnace with coal for the night and stay there until it was burning in good shape, then to close the draft door. As this performance requires from twenty to thirty minutes I concluded to make a self-acting device which would close the draft and leave the furnace safe, without any further attention on my part, after putting in the coal and opening it up to burn. As some other boys may like to build the same regulator I will tell just how to make one and how it operates.

Referring to Fig. 1, you will see a straight cord is attached to the draft door of the furnace D, and is run over the pulley P and finally is attached to a small piece of iron H. This piece of iron is hinged to I. To the other side of H another cord G is fastened, which passes over the pulley N and terminates in any convenient place in the rooms above. This piece of iron H is held in place by the release A. Now C is a coil of wire from a door bell. R is an armature which works A on pivot J. M is a U-tube, filled with mercury, one end being connected to a half liter glass flask F by the tube T, and the other end terminates in an overflow tube O. B is a battery of three bichromate cells which are connected up with the C and the platinum points 1—2, which are fused into the U-tube.

On fixing the furnace the iron piece H takes position X, this being the normal position when draft door D is closed. On arriving upstairs I pull the cord G, which causes the piece H to become fixed in the vertical position by means of A. This opens the draft door at the same time. Now when the furnace heats up sufficiently it causes the air to expand in F, which causes the mercury in M to rise a little above the point 2. This immediately causes a current to flow through C which in turn draws R towards it, raises A and causes H to drop to position X. This shuts the furnace door.

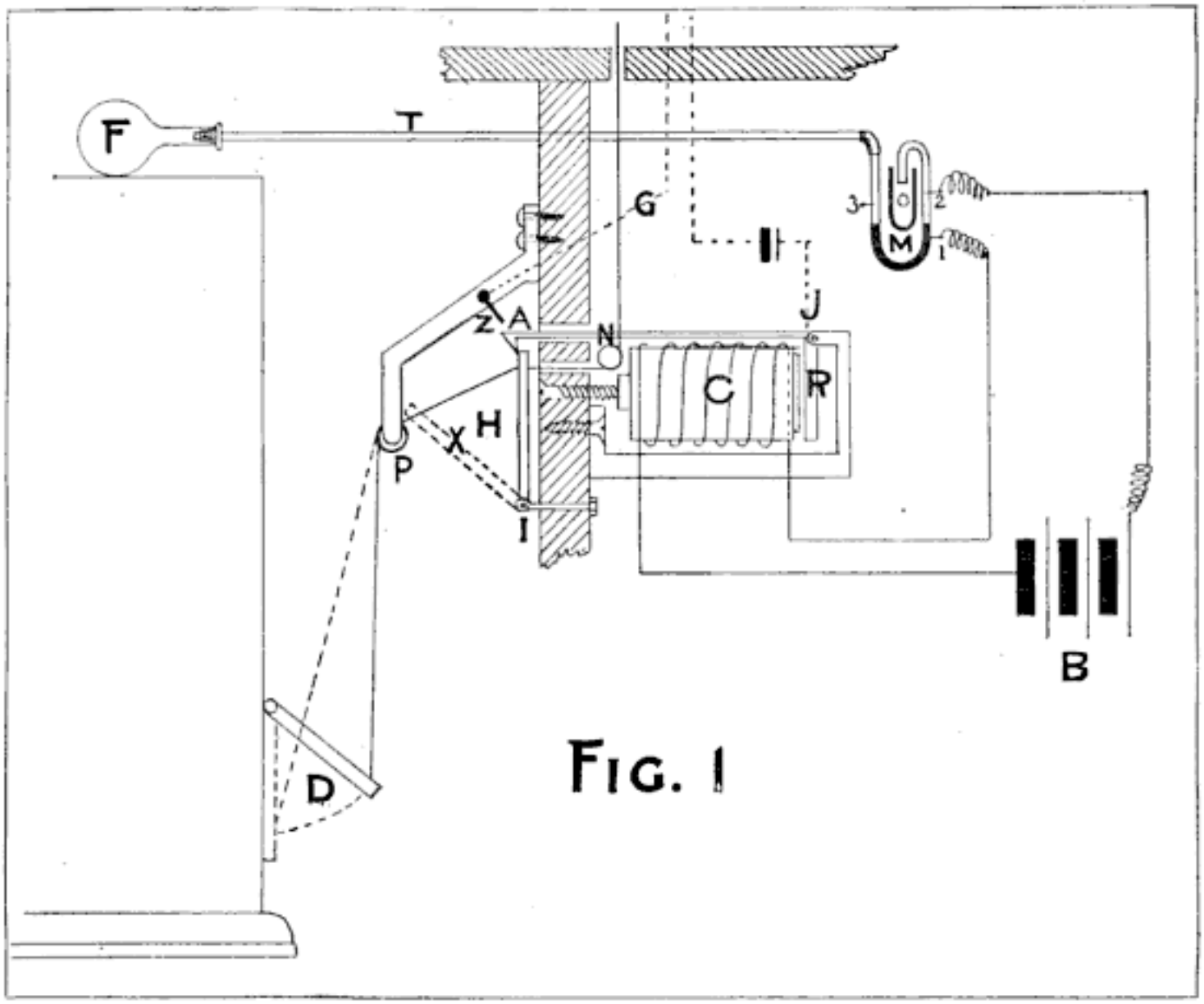


FIG. 1

Now the furnace, of course, cools down, thus causing the air in F to contract and consequently opening the circuit through C. If at any time the furnace should overheat, the raising of A, on which is grounded a wire from a signal bell upstairs, will make a circuit through the bell by means of the point Z and wire leading therefrom. This bell also serves to tell me whether H has dropped or not. This same device of regulating the draft D can be used to regulate the damper, found on the coal doors of most furnaces, by simply fusing a platinum point on the other side of M and changing the cord which is attached to D. A two-contact switch could also be inserted to throw connections from 2 to 3. It would work in this manner: The damper door, of course, which keeps a low fire, would be up in a position similar to D; on the furnace cooling too much, connection, due to contracting of air in F, would be made through 3 and C, causing H to drop, thus closing door. This simple device worked very well all last winter and gave me no trouble whatever.

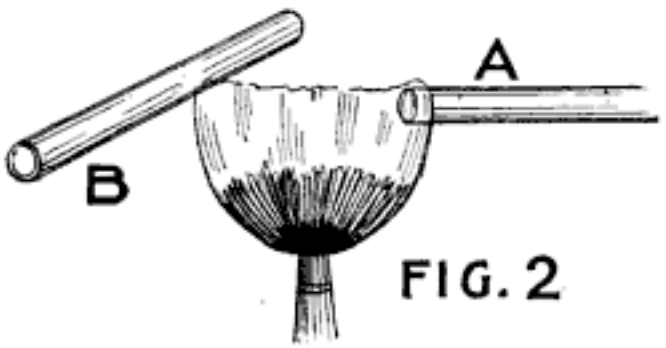


FIG. 2

If you cannot readily procure a U-tube, you can make one, as I did, and the work is interesting.

The U-tube is constructed in the following manner. A glass tube is closed at one end. This is done by holding the tube in one corner of a gas flame, somewhat near the dark area (A, Fig. 2), and constantly turning the tube, when it will be found that the glass has melted together. Now, after it is cool, about 3 or 4 inches from the sealed end, the tube is held steadily so that the flame will heat one small portion (B, Fig. 2). After this small portion is heated blow into the tube, not very hard, but just enough to cause tube to bulge out. Allow to cool. Then reheat the small bulged portion, blow quite hard, so that the glass will be blown out at this point, forming a small hole. Now insert about a half inch of platinum wire and reheat, holding platinum wire by means of a small pliers so that it will be partly in the tube and partly without. The platinum will stick to the glass, and if glass is sufficiently heated one will be able to pull it, by means of pliers, from one side of the hole to the other, thus sealing the wire into the tube. Another wire is sealed in the same way about an inch from the first. Now, to bend the tube, one must hold it, with both hands, in the flame and turn constantly until soft. Quickly withdraw from flame and bend, just as you would a piece of copper wire. Allow to cool slowly.

The several tubes are connected with a short piece of rubber tubing.

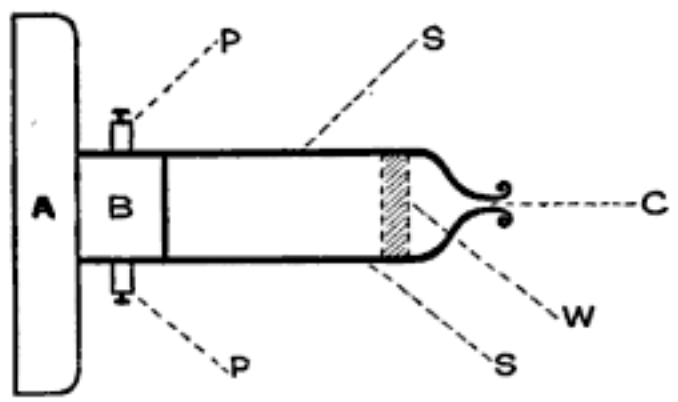
The total cost of materials for constructing the apparatus complete will not cost over one dollar—they cost me sixty cents.—Contributed by M. G. Kopf, Lewis Institute, Chicago.

HOW TO MAKE A SIMPLE FIRE ALARM

A fire alarm which is both inexpensive and simple in construction is shown in the illustration. Its parts are as follows:

A, small piece of wood; B, block of wood nailed to A; S, S, two pieces of sheet brass about ¼ in. wide, bent into a hook at each end; P, P, binding posts fastening the springs S, S, to block B, so that they come in contact at C. W is a piece of wax crayon just long enough to break the contact at C when inserted as shown in the illustration.

When these parts have been put together in the manner described, connect the device in circuit with an electric bell, and place it behind a stove. When the stove becomes too hot the wax will melt at the ends, allowing the springs to contact at C, and the alarm bell will ring.—Contributed by J. R. Comstock, Mechanicsburg, Pa.



Simple Fire Alarm

A speed of 83 miles an hour was made in a test of an electric locomotive pulling a heavy train on the New York Central recently.

HOW TO MAKE A BELL TENT

Cheaper Than Buying a Tent and Just as Good

A bell tent is easily made and is nice for lawns, as well as for a boy's camping outfit. The illustrations show a plan of a tent 14 ft. in diameter. To make such a tent, procure unbleached tent duck, which is the very best material for the purpose, says the Cleveland Plain Dealer. Make 22 sections, shaped like Fig 3, each 10 ft. 6 in. long and 2 ft. 2 in. wide at the bottom, tapering in a straight line to a point at the top. These dimensions allow for the laid or lapped seams, which should be double-stitched on a machine. The last seam sew only for a distance of 4 ft. from the top, leaving the rest for an opening. At the end of this seam stitch on an extra gusset piece so that it will not rip. Fold back the edges of the opening and the bottom edge of the bell-shaped cover and bind it with wide webbing, 3 in. across and having eyelets at the seams for attaching the stay ropes. Near the apex of the cover cut three triangular holes 8 in. long and 4 in. wide at the bottom and hem the edges. These are ventilators. Make the tent wall of the same kind of cloth 2 ft. 2 in. high. Bind it at the upper edge with webbing and at the bottom with canvas. Also stitch on coarse canvas 6 in. wide at the bottom, and the space between the ground and the wall when the tent is raised, fill with canvas edging. Stitch the upper edge of the wall firmly to the bell cover at the point indicated by the dotted line, Fig. 2.

For the top of the tent have the blacksmith make a hoop of ¼-in. round galvanized iron, 6 in. diameter. Stitch the canvas at the apex around the hoop and along the sides. Make the apex into a hood and line it with stiff canvas. Have the tent pole 3 in. in diameter, made in two sections, with a socket joint and rounded at the top to fit into the apex of the tent.

In raising the tent, fasten down the wall by means of loops of stout line fastened to its lower edge and small pegs driven through them into the ground, Fig. 5. Run the stay ropes from the eyelets in the circular cover to stakes (Fig. 5) stuck in the ground. Use blocks, as in Fig. 6, on the stay ropes for holding the ends and adjusting the length of the ropes.

ENAMELING A BICYCLE FRAME

Make an enamel by mixing 2 oz. burnt umber with 1 qt. boiled oil, heating, and then adding 1 oz. asphaltum. Keep the mass hot until thoroughly mixed, says the Master Painter. Thin with turpentine while still hot.

Use a camel's hair brush for applying the enamel and allow it to set; then place the article in an oven, bake for six or eight hours at a temperature of 250 deg. F. When cool rub down with steel wool. Apply a finishing coat and allow it to bake eight hours at 250 deg. F. Rub down with a soft rag, varnish and bake again at 200 deg. F. Heat and cool the frame gradually each time. Black enamel is easiest to apply and bakes hardest, but requires a temperature of 300 deg. Colors can be baked at from 200 to 250 deg.

A little borax added to flour paste will double its adhesive power, and keep it from souring, also.

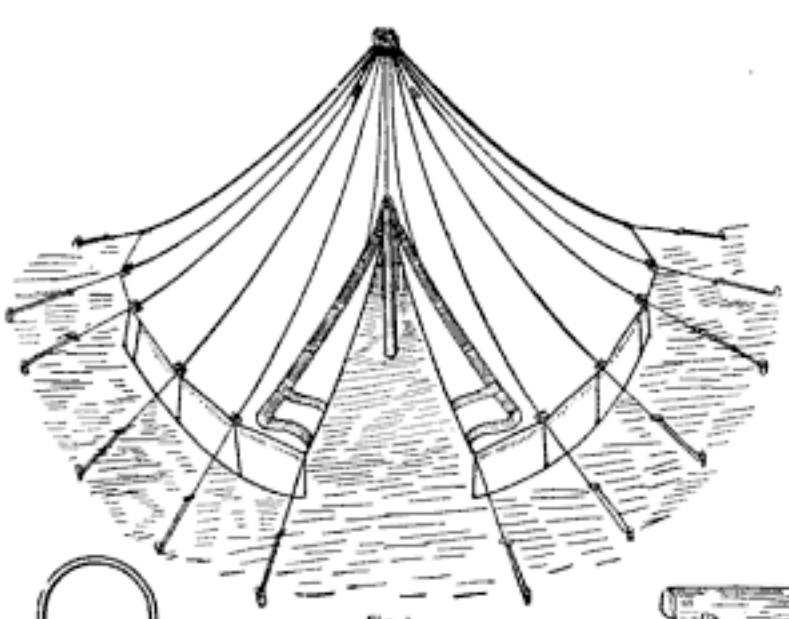


Fig. 1

Fig. 4

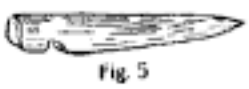


Fig. 5

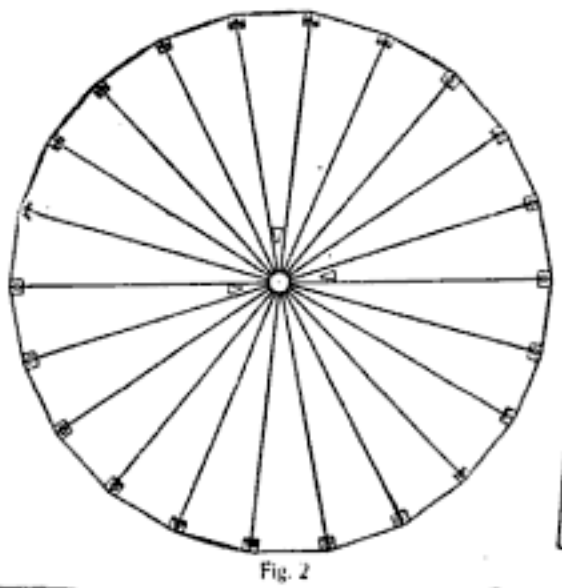


Fig. 2

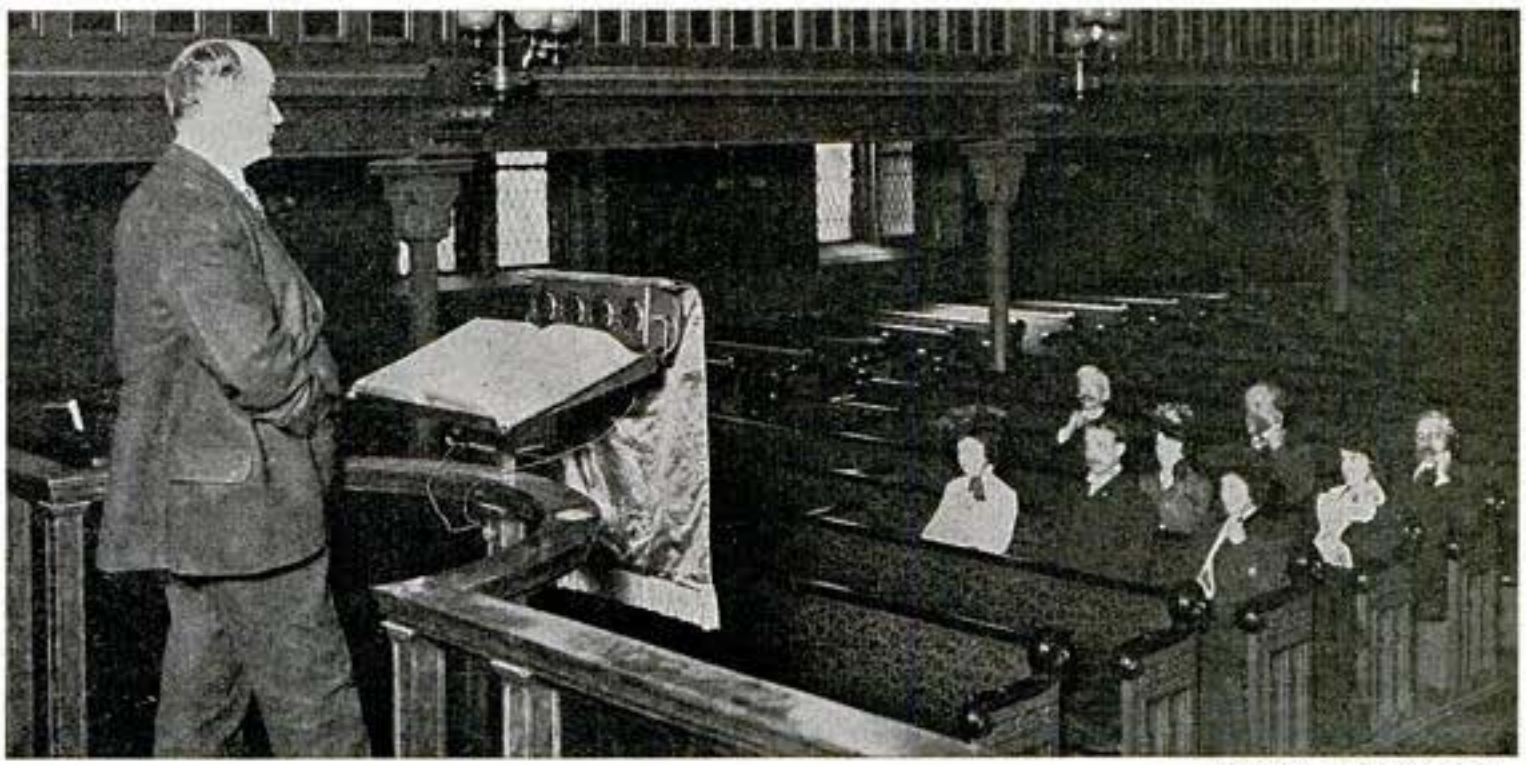
Fig. 3

Fig. 6

THE "ACOUSTICON" BY WHICH THE DEAF HEAR

Those people who have long ago relinquished the delights of attending operas and concerts, and have perforce given up the comfort of church services, because of defective hearing, are once more to listen to and drink in all that the normal sound-loving human being enjoys. The "acousticon" is a new apparatus, a combination of the telephone and the microphone, by the use of which the deaf are able to hear. Churches and theaters are already taking advantage of this important invention and in a few years every public hall of any importance will be fitted up with this or simlar apparatus for the benefit of partially deaf auditors.

The acousticon consists of a cup-shaped receiving apparatus, corresponding to the telephone transmitter, into the open side of which the sound waves enter, says the American Telephone Journal. The inner surfaces of the device are shaped to reflect the sound waves until they strike the center of a diaphragm mounted in the cup at right angles to its axis. Wires are run from this transmitter under the carpets to seats in any part of the auditorium and terminate in a receiver or earpiece very much like a telephone receiver, but different in construction, hung conveniently in the pew. The deaf person who uses the receiver is able to hear music and the sermon. The device was first tried in the Madison Avenue Baptist church in New York and two women who had not heard a sermon in twenty-five years used it and pronounced it satisfactory. Now this church has many earpieces in use and other churches are installing the acousticon. The device was also installed in one New York theater. Four of the microphones were placed on the stage, just behind the footlights. These were connected in series and all of them put in series with the small powerful battery that furnishes the current for the apparatus. Where several earpieces are connected to one transmitting device they are cut in in multiple with each other. Thirty-two men and women, who had ceased to attend shows because they could not hear, were enabled to enjoy the choruses in the revival of "Florodora" in New York by this means.



Courtesy Am. Telephone Journal.

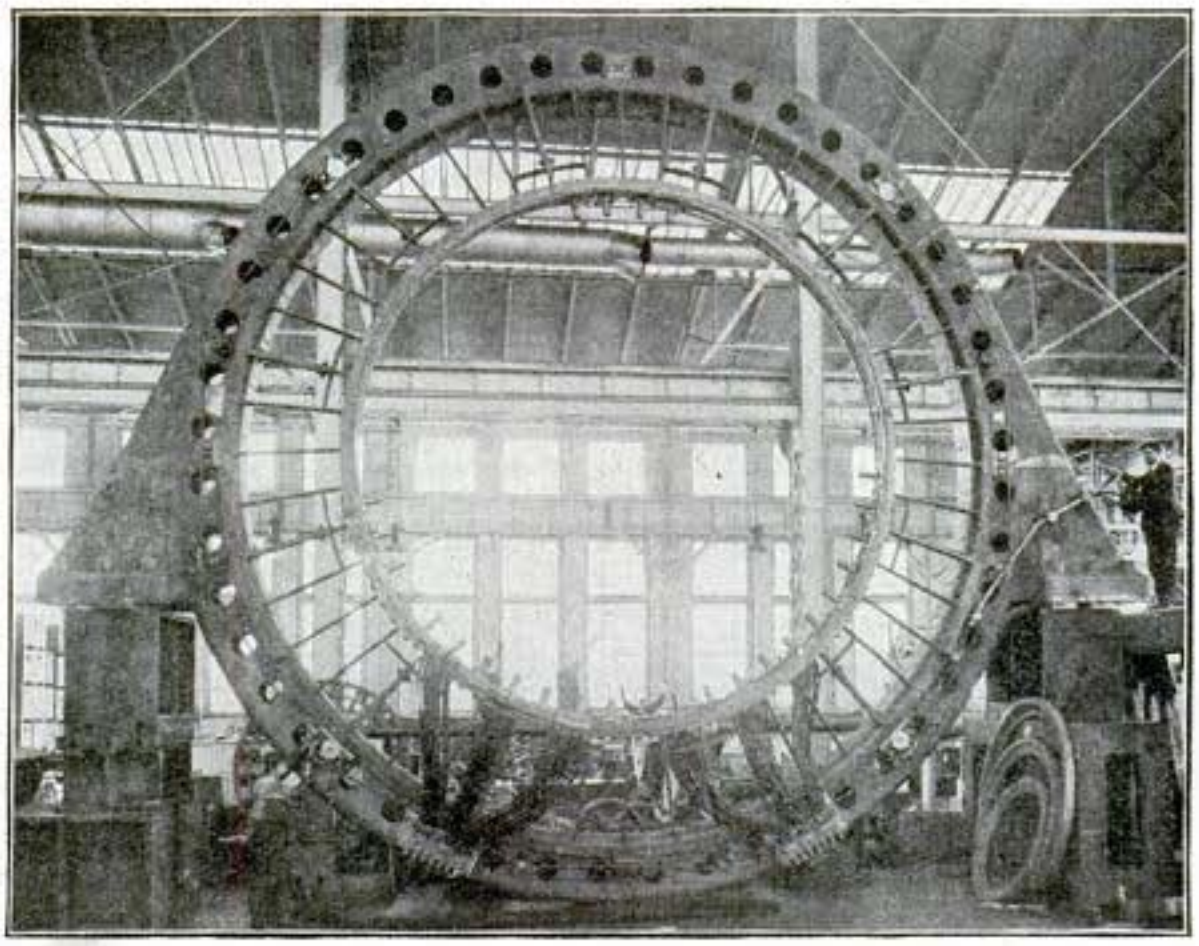
The Acousticon Installed in the Madison Avenue Baptist Church, New York City. The transmitting apparatus is on the pulpit in front of the speaker. The auditors are listening through the earpieces

A portable apparatus which can be carried by a mute is manufactured also. The sound receiver is placed on a table or desk and the earpiece, which is connected by a cord, is held to the ear. This apparatus is very light and convenient to handle.

A submarine boat provided with strong grappling hooks operated by electricity is being tested for picking up articles at the bottom of the sea at Genoa, Italy. The boat descended 348 ft., at which depth the crew breathed without difficulty.

LARGEST DIRECT CURRENT GENERATOR EVER BUILT

The largest direct current generator ever built was recently installed at a lighting plant in Cincinnati, O. The machine is of the 3,200 kw. engine type, 38 ft. in diameter. The commutator is 180 in. in diameter, and the total weight of the generator is 350,000 lbs. The enormous size of the generator is best appreciated by comparing it to the height of the men near it, and who appear as mere pigmies. Our illustration is by courtesy of the Bullock Electric Co.



"The Machine is 38 Feet in Diameter"

UNDERMINING THE ALPS

Engineers of this century have the faith that can move mountains. Switzerland has another Alpine tunnel project in mind, of which she has been dreaming since 1897. The new tunnel, if cut, would connect Frutigen and Raron, passing under the Bernese Alps and being of great commercial advantage to the city of Berne. Should the tunnel pass under Lotschberg, it would be the longest in the world. The estimated cost is $12,376,000, but it is believed that it would more nearly approximate $16,000,000.

LEATHER RAILROAD TIES

Leather railroad ties are being used on the Russian government railroads, report German papers. Tarred wood and iron have been tried for the purpose with unsatisfactory results. It is expected that the leather ties will not be affected by air or heat, nor will they split when spikes are driven into them.

NEW ANESTHETIC FOR THE EYE

A new anesthetic called yohimbine is prepared from the yohimbehe tree which grows in West Africa. The preparation comes crystallized in white silklike needles which are soluble in alcohol, ether and chloroform. Administered hypodermically, the anesthetic produces local anesthesia of two hours' duration. Its most important use, however, is for rendering the cornea of the eye insensible by merely dropping the solution upon the part. It causes itching at first, but in two minutes diminishes the sensibility of the cornea, and in ten minutes produces complete insensibility, with no perceptible effect on the pupil of the eye. It does not injure the tissues and is not poisonous.

REPAIRING OCEAN CABLES

Breaks in ocean cables are of frequent occurrence for all the precautions that are taken against them. Currents and tide may fray them, icebergs grinding over them may cause a break, and often the fishermen's anchors on the Grand Banks do great damage. A fleet of about 40 vessels is maintained to keep the cables of the world in repair, says the Marine Journal.

Across the bed of the Atlantic are laid fifteen cables, four are "dead," or out of service. A break in a cable is located approximately from the cable offices by means of sensitive instruments which record the proper working resistance of the cable and also the resistance of the portion between the office and the break. Cable repair ships always keep up steam and lie in convenient ports so they can sail immediately upon orders. Besides the large crews required for these ships they carry electricians or repairers and experts.

The defective cable is cut by a mechanical grapnel which grips one end and brings it to the surface and is then spliced. The captain must be very careful to locate the right cable instead of getting hold of some other one that is working all right. This, indeed, sometimes happens and entails great expense as well as indignation. The work is expensive enough as it is. It costs $1,500 a day to maintain a cable ship and the cable used to make the splice costs from $750 to $1,000 per mile, and sometimes as much as a 150- to 300-mile length is required. One break on record took 116 days to mend at a cost of $375,000; another required 87 days, costing $230,000.

HINTS ON GAS ENGINE IGNITER TROUBLES

The essential to a good spark is that a good contact shall be made before the contact points are forced apart.

In practically all make and break igniters the movable electrode passes through an iron or a bronze bushing and the current must pass from this bushing to the axis of this electrode before reaching the contact points, says Gas Power.

Under certain conditions the contact between the outer stem and its bearing, i. e., with the metal of the engine, may be so poor that only a very small current could flow; so that on breaking the contact the spark is too feeble to light the gas.

Oftentimes when this condition exists it can be seen by shielding the igniter mechanism from the light—if the contact between igniter stem and bearing is very poor small sparks may often be noticed around the igniter parts outside of the cylinder.

The cause of this trouble may be due to the presence of too much oil on the igniter bearing; it is, however, more often due to wear and a poor fit between the stem and its bearings; for where the bearing is poor the gases and burnt oil flow through by reason of the high temperature which the stem reaches after a few minutes running; the oil and soot bakes on it forming with the "fire rust" a coating that is an extremely poor conductor.

Add to the resistance thus offered—that due to the accumulation of fresh or of burnt oil on the contact points proper, inside the cylinder an amount of resistance is easily reached which prevents the passage of enough current to give a satisfactory spark.

Nearly all make and break igniters on commercial engines are defective in design in that they permit of this condition occurring.

The igniter stem bearing is one of, if not the most important bearing on an engine.

It should work freely—be as near free from leakage and free from friction as possible.

It should always be kept well oiled.

All of which conditions are practically impossible with a simple straight bearing or a valve-head bearing at the inside of the cylinder.

When the stem is flooded with oil a good contact is not formed for the current (for oil is a poor conductor and when it completely surrounds the stem the insulation is absolute.) Yet when well oiled the igniter works better than when the bearing is dry.

The igniter stem should be kept cool enough not to burn the oil.

Oil should be fed to this bearing in ample quantity and regularly—best perhaps by a special oil cup or by force feed.

The prevention of the loss of this oil and the keeping of the bearing in good condition could be obtained by making a valve shoulder near the outside end of the bearing or by surrounding the outer end with a stuffing box and lastly a perfect metallic contact should be had—either by soldering a flexible wire direct to the igniter stem—or to copper brush pressed against the stem at its extreme outside end. Where such provision is properly made it will be found that ample spark for all purposes can be furnished with from one-third to one-half the battery power usually found to be necessary.

NEW WHITE PAINT TO COMPETE WITH WHITE LEAD

A new white paint which is said to excel white lead in covering power, smoothness of surface, durability and cheapness has been patented in Germany. In its production, burnt lime containing magnesia, is saturated with a hydrocarbon and fired until all the carbon is burned. The material is then ground fine and colored ready for treatment with linseed or other saponifiable oils. This paint is said to dry quickly without driers and to be unaffected by light, ammonia, sulphurated hydrogen or sulphurous acid. After some months the paint hardens like enamel, possesses a dull gloss, does not blister in the sun and is washable.

AMERICAN COIN FOR EUROPE

Since it seems to be determined that the expenditure of Americans who go to Europe for the summer averages $1,000 for each person, it follows that $200,000,000 of the so-called balance of trade of $400,000,000 this year will be covered by these foreign voyageurs. The rush to Europe this year is breaking all records. The number of first and second class passengers who have already been carried across is 80,000. Thirty thousand more will go in July, and the total for the season is estimated at 200,000.—Hartford Times.

King Oscar of Sweden once passed through a small town, festively decorated in his honer. One stone building bore a large transparent board, inscribed, "Welcome, Your Majesty!" "What house is that?" asked the king. "That is the town prison," was the answer. Whereupon his majesty, laughing, said: "That is rather too much politeness."

SHORT MAXIMS FOR THE SHOP

The following chips are gathered from the editorial columns of a recent issue of the Woodworker:

The day of the wood butcher may not be entirely over yet, but the demand for his work is certainly getting very limited.

* * *

The foreman who lets his work run him, instead of running his work, is in for a mighty hard race until he changes this condition.

* * *

A shaft out of line may not attract as much attention as a pulley out of balance, but it generally uses up more power in the end.

* * *

Thomas A. Edison is credited with saying that real genius is made up of three parts inspiration and ninety-seven parts perspiration.

* * *

The foreman who does not think it necessary to be on hand at the factory when the whistle blows in the morning, is not likely to make a very pronounced success of his business.

* * *

The man who is always asking his employer for more money may get there first, but the man who gets his wages advanced without asking for it is the one that will stay longest.

TRAVELING COURSES OF INSTRUCTION FOR FIREMEN

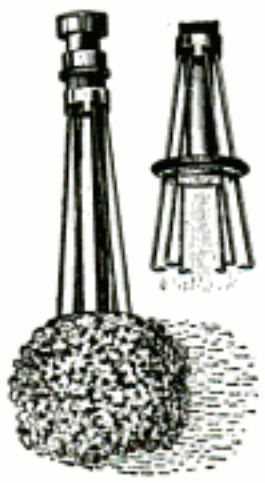
Three years ago the ministry of commerce and trade in Germany instituted "traveling courses of instruction for firemen," with the object both of preventing smoke and securing a safe and economical treatment of steam boilers. The instruction is both practical and theoretical, and is given by an academically trained engineer and a competent fireman. The course covers 14 days, and more than 500 men have been benefited by it. The smoke nuisance and its remedy is largely in the hands of firemen.

EGG MEMBRANE HEALS

Egg membrane placed upon the surface of wounds is declared by Dr. Amat, of Paris, to have a healing effect and the treatment to be followed by favorable results. Six or eight pieces of the membrane are applied to a burn or ulcer, then it is covered with tin foil and fastened with dry antiseptic bandages. When in about four days the bandage is removed the wound will present a healthy growth of granulations. The membrane may grow in with the tissues or it may not adhere at all.

NEW MECHANICAL SPECIALTIES

AUTOMOBILE WASHER.—Consists of a spraying nozzle fitted with hooked rods which hold a sponge in front of the spray. The nozzle is attached to the hose in the usual way and a ring to which the rods are jointed is moved toward the tip of the nozzle spreading the hooks apart. The sponge is then inserted and the ring pushed towards it bringing the rods together so that they hold the sponge firmly, and are buried in the sponge so they cannot scratch the paint. The water is then turned on and the machine washed without getting the hands wet. A woolen sponge is provided for the device, as it is more lasting than the animal growth.



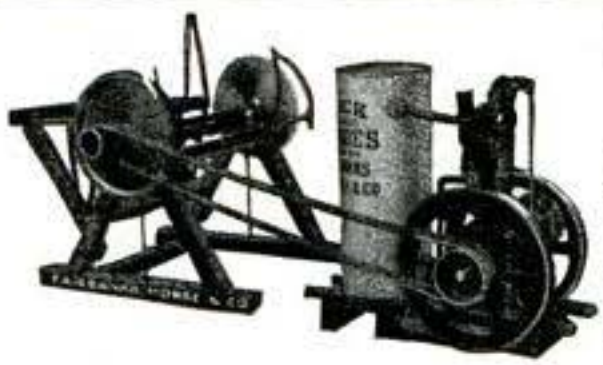
REFRIGERATOR BASKET.—For automobiles, fishermen, hunters and picnic parties. Basket is lined with asbestos and metal and divided into two compartments, one of which will contain sufficient ice to last all day.

Refrigerator Lunch Basket

APPAREL DISINFECTOR.—A French invention for disinfecting garments which have been exposed to contagious diseases. The disinfecting liquid is placed in the upper compartment and the top screwed

Disinfecting Apparatus

tightly. An alcohol lamp placed immediately below quickly generates steam which is forced with considerable power from the nozzle of the spout.



BRACKET FOR TELEPHONE RECEIVER.—A bracket for holding the telephone receiver to the ear while talking over the phone is a new convenience invented by a Pennsylvania woman. The bracket is adjustable to any height required and is mounted on the telephone stand near the base. The

Telephone Receiver Support

shank portion of the joint carries a lazy tongs having a pair of arms for embracing the receiver. The arrangement permits of the free use of the universal calling and ringing-off arrangements of the present telephone system.

CASH REGISTER DEVICE.—A new attachment for cash registers to prevent any chance of mistake or false registration consists of an electric display device by which the amount of the sale is flashed

Displays Amount of Sale

out in illuminated characters at some distance from the register. The dollar sign and the period burn continuously and the numerals are operated by varying the contacts. Whenever a purchase is registered the amount of the sale is flashed out.

ELECTRIC MOUTH LAMP for dentists enables the making of gold filling at night or on dark days. In fact, by use of the removable mirror attached to the lamp a much stronger light is focused on the cavity than obtainable at any time with sunlight. The lamp is placed in a holder about the size of a lead pencil and will burn 8 hours steadily from one cell of dry battery. Lamp costs $5; new batteries 40 cents each.

POROUS PIE PLATES.—Made of wood-pulp and intended to replace the tin plates widely in use. The porous plate is said to absorb the fats from the bottom crust of the pie, making it less indigestible. Cheap, and being turned out at the rate of 300,000 per day.

INVERTED MANTLE GAS LAMP.—This new lamp is being used to a large extent by the gas companies of London. It gives an exceptionally brilliant light having the advantage of a glass mantle rest, thus reducing vibrations to a minimum, and prolonging the life of the mantle.

The Plumber and Decorator, London, states the lamp is known as the "Smitz Inverted Lamp" and is quite attractive in appearance.

LIQUID RUBBER GLOVES.—For surgeons or to protect the hands while performing housework, etc. Consists of a solution of rubber into which the hands are quickly dipped and removed receiving a thin film of the rubber which instantly dries. Does not interfere with the movement of the hands nor the sense of touch, and is impervious to moisture. Another solution is provided with the rubber into which the hands are dipped to remove the film.

ELECTRICIAN'S SCREWDRIVER.—This is a tool just put on the English market. The revolving head is a useful feature, as by placing the index finger in the hollow part of the loose head and the blade of the screw driver in the slot of the screw it may be turned rapidly between the thumb and second finger by means of the knurled boss in the center.

Has a Revolving Head

THE INVENTOR

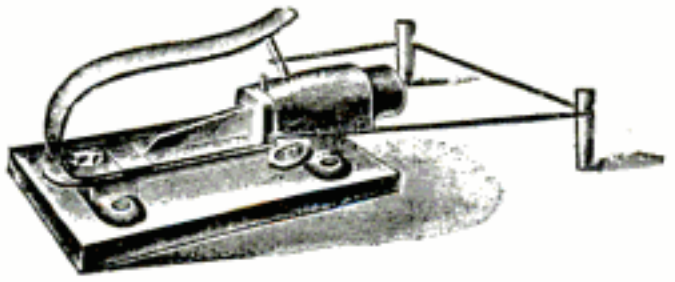
He studied a score of years, living on crust and shred;
He failed, and he tried again, deaf to what scoffers said.
At last he gained his reward—the ones who had scoffed believed,
And gave him belated praise for the triumph he had achieved.

He died with a hopeful heart—in a room that was poor and bare,
Though his useful device had made another millionaire—
He died in the midst of want and was quietly put away,
And the world then saw the size of the debt it had failed to pay.

But why should we mourn for him? The service he did was good,
And the knowledge of that was his—he saw and he understood!
What, then, if he died in want, what though he died aggrieved?
He had rendered a full account of the talent he had received.

—S. E. Kiser in Record-Herald.

SET GUN.—Eight inches long; used for killing foxes and small game; load is discharged when the



animal touches the bait. Not effective except at very short range. Made by Edward Kettner, Cologne-on-the-Rhine, Germany.

PRIZES FOR ESSAYS ON LEAD POISONING

The following prizes for essays on means of combating lead poisoning are offered by the International Arbeitsamt, Basel, Switzerland:

1. Most practical method of eliminating the danger of lead poisoning during the process of handling lead ores. Best essay, $1,190.

2. Elimination of the danger of lead poisoning in lead smelting works. Best essay, $2,380.

3. Elimination of the danger of poisoning in chemical and electrical works where lead is in use. Best essay, $595; next best essay, $357.

4. Most practical method of avoiding lead poisoning in trades such as enameling, painting, etc. First prize, $357; second prize, $238; third and fourth prizes, $178.50 each.

5. Elimination of the danger of lead poisoning in factories where large quantities of lead are used, as in type foundries, printing establishments, etc. First prize, $357; second prize, $238; third and fourth prizes, $178.50 each.

The terms of the offer require that each essay contain a systematic description of the source of lead poisoning, in which the mode of production is described, and the dangers existing in each stage of the process, in transportation, etc., are mentioned. Causes of lead poisoning, as working too long at certain processes, uncleanliness, insufficient food, etc., must be given, also.

The proposals made must give the possibility of elimination of the danger in such a manner that no objection can be made on technical, hygienic or economic grounds. The dangers are to be given, so far as possible, in classes, in order to make it clear at what stage of the process or under what conditions there is greatest and least danger.

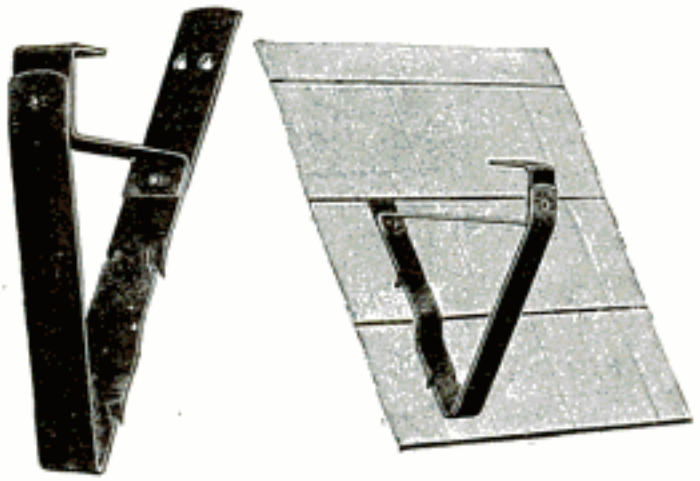
In proposals for new apparatus or alterations in process, the cost and saving involved in such proposals must be given. For instance, in a proposal for substituting a mechanical process for hand work, the cost of machines, loss by depreciation and interest, and, on the other hand, the wages and other expenses saved must be mentioned. The advantages gained by such methods, as, for instance, the avoidance of frequent changes in the staff, the training of a good staff, and increase in ability must also be given.

It is preferable that the essays contain proposals for improving the existing laws upon this subject in all states, and the alterations in legislation which would be necessary to carry out the proposals. They could also contain copies of proposed instructions to be affixed in factories for the guidance of the workmen.

The present laws upon this question are contained in the volume Gesundheitsgefahrliche Industrien, issued by G. Fisher, Jena, 1903, and in the Bulletin des Internationalen Arbeitsamtes, 1901-1904. These books can be found in a number of libraries in America.

At the end of the essay all the proposals made in it must be summarized. Papers may be written in English, French or German. The manuscript must simply bear a title on the cover and must not be printed. The name of the author must be enclosed in a sealed envelope, bearing the title of the essay. Address the essays to "Das Internationales Arbeitsamt, Basel, Switzerland," send them by registered mail and so they will reach their destination by or before December 31, 1905.

ROOF BRACKET.—This bracket is designed to combine safety to the workman with a minimum of damage to the roof. For use on unshingled roofs nails are driven through the small holes at the top.



Scaffold Bracket

There is a safety hook for holding the footboard in position. The greater the weight on the bracket the more firmly the teeth are driven into the wood.

CRANE CO. MAMMOTH PICNIC.—The Crane Co., Chicago, celebrated its 50th anniversary with a picnic for all its employes and their families, numbering over 13,000 persons. Sixteen special trains carried the crowd to the country, all the expenses of the day being paid by the company. Valuable presents were given to a large number of old employes. It will be remembered the Crane Co. makes an annual division of profits with its employes, $250,000 being so distributed last Christmas.

Shop Notes for 1905; 200 pages, 385 illustrations. Price, 50 cents.

MAKE THE PAPER TO SELL

"Poison!" "Arson!" "Suicide!"
"A Thousand Killed in a Big Landslide!"
"Japs Take Port of Cromcroft!"
"Dowie Hides in an Organ Loft!"

"Swindle!" "Boodle!" "Holocaust!"
"Railroad Smashup, Ninety Lost!"
"Long Shot Takes the Handicap!"
"Poodle Dies in a Lady's Lap!"

"Murder!" "Typhus!" "Black Smallpox!"
"Foraker Calls on George B. Cox!"
"Strikers Must Work or Go to Jail!"
"Machen Out on $10,000 Ball!"

"Earthquake!" "Cyclone!" "Hypnotic Trance!"
"Bulldog Tore the Lover's Pants!"
"Died at Home While They Buried His Wife!"
"Ingersoll on 'A Christian Life'!"

"Duel!" "Mayhem!" "Prays for Rain!"
"Italians Fight on a Panhandle Train!"
"Kept Marriage Secret Nearly a Year!"
"Carrie Nation Drunk on Beer!"

"Briber!" "Fakir!" "Man Ate Son!"
"Senator Dick in Washington!"
"Work is Rushed on Men-of-War!"
"Cut in Two by a Whirling Saw!"

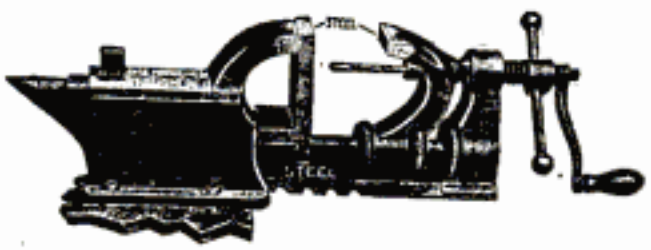
"Auto Ran Into a Bar!"
"Crushed to Death by Electric Car!"
"Ex-Convicts Must Leave the Town!"
"Kansas Banker Can't Be Found!"

That's the kind of stuff we read,
"Frightful Deluge!" "Awful Deed!"
Let us read something better than
"Strychnine Put in a Milking Can!"
—Andrews, No. 34,105, Ohio Penitentiary News.

FISH SPEARING GUN.—A recent French invention, made by The Manufacture Francaise de'Armes, St. Etienne, France. This is a cross-bow gun, shooting a harpoon to which is attached a line which unwinds from a reel by means of which the harpoon is recovered.

For Spearing Fish

COMBINATION VISE, ANVIL, DRILL AND HARDY.—The dimensions of this device are as follows: Height, 8½ in.; width of jaws, 2½ in.; jaws open, 6 in.; depth of throat, 5½ in. It is converted from a vise to a drill instantly by inserting the drill bit. It will take any size square-shank drill bits, drill ½ in. holes readily, or will drill smaller or larger holes. The jaws are faced with steel and the top of the anvil is case-hardened. The device can be used as a portable drill by taking out the draw bars, and removing and reversing the loose jaw.



Convertible Vise

THE MAN WHO'S AFRAID

I've paid close heed to the ways of men,
I've observed what the world calls luck,
I have silently marveled, now and then,
At the potent power of pluck;
And this as a bit of truth I hail,
A sentence that's worth one's heed;
The man who is always afraid he'll fail
Doesn't stand much show to succeed!

—Success.

THE AGE OF MAGIC

Nikola Tesla takes issue with Edison and declares that we will soon be talking clear around the world. Anything seems possible in this age of magic. Wireless communication around the world would crown the most remarkable series of inventions ever given by a single generation to the world.

The wireless telegraph is an invention of the last ten years. Marconi, its inventor, is still in his thirties.

The death of John Pratt, inventor of the typewriter, impresses the newness of that necessary fixture in every business office in the world. The idea was born in 1863.

Alexander Graham Bell, inventor of the telephone, is still living.

Edison, whose incandescent light has turned night into day, has not reached his sixtieth year.

Serpollet began his experiments with self-propelling road vehicles in 1894. Within eleven years thousands of automobiles have sprung into existence.

Architecture, the oldest art known to man, has been revolutionized in our day by the elevator.

A few years ago the world was laughing at an Austrian scientist who claimed that he could look through the human body by means of the Roentgen ray. Today the fact has become commonplace.

It is an age of magic. It is a generation that seems bewitched. The veil of natures mysteries has been lifted, revealing wonders of which our fathers dared not even dream.

When Tesla declares that we shall soon be talking clear around the world, why should we doubt?

HINTS TO INVENTORS

That great medical authority, the London Lancet, urges the invention of a safer and more satisfactory method of fastening a woman's hat to her head. The universally used hat pin is somewhat dangerous and in a strong wind pulls vigorously on the roots of the hair.

STREETS OF GLASS

In France there is a concern manufacturing paving bricks from glass. Several French cities have pieces of pavement laid with these glass bricks and the manufacturers are sanguine of the ultimate success of the industry. Where uniformity of texture and color is not required in this artificial stone, as in paving bricks, old glass, such as broken bottles and window panes is the material used in its manufacture. Ornamental forms and tiles for bathrooms, operating rooms, etc., are molded from glass made of sand, carbonate of lime, sulphate of soda and potash. The cost of production averages 96.5 cents per 10.76 square feet.

This stone resists the action of chemical products is impermeable to moisture and is so hard that it cannot be easily cut or drilled—the last characteristic being a drawback.

The paving bricks are 7.87 in. long, 3.74 in. wide and 1.78 in. thick. They are laid with mortar in a concrete foundation with a wooden template between them. These pavements while not giving bad results have not worn as well as those made of natural stone.

In tests the glass product, which is called "Garchey stone," stood a pressure of 28,744 lb. per square inch, while granite stood a pressure of only 9,245 lb. After being subjected to a temperature of 20° below zero C. it resisted a crushing pressure of 28,845 lb. per square inch. Held against an emery wheel at a constant pressure of 3½ lb. per square inch, the wheel revolving at the rate of 1,777 ft. per minute, Garchey stone ranked No. 15 among 27 other materials.

The United States consul at Havre, France, says that the not unqualified success the glass product has met with is due to the fact that the process has not been sufficiently exploited.

WANTED

We desire the names and addresses of Practical Inventors and Skilled Mechanics in all trades. If you know of any such parties and will send us their names and postoffice addresses we will compensate you for your trouble. Popular Mechanics Patent Bureau, Journal Bldg., Chicago.

A SHORT HISTORY OF PORTLAND CEMENT

22,000,000 Barrels Made in the United States in 1903

Though much has been written during the past few years on uses of cement and "Cement Construction" it has been largely of a technical character so that the average person has little conception of its extent, its adaptability or characteristics. Portland cement is entering more and more into the various constructions formerly built of wood, stone or brick and iron, writes Herbert R. White in Concrete. It is the one material more than any other which is making the great constructive era of the world. This is now the concrete age.

As an introduction to this form of construction it may be of interest to glance at the history of the fundamental element—cement. The first authentic account the writer finds of the use of cement in any large way was by the ancient Romans who used a mixture of fat lime and volcanic dust, producing a cement of considerable hydrolicity. Previous to this time the Egyptians used mortar of the nature of hydraulic lime, from which was no doubt constructed the pyramids and other great works.

In 1755, after the destruction by fire, of the Eddystone Lighthouse, John Smeaton, an English engineer, who was engaged to rebuild the same with stone, realized the importance of obtaining a cementing material superior to lime mortar which would harden under water and would have sufficient strength to withstand the action of the waves. About this time, after testing the various limestones of England, he established the principle that a limestone, yielding, when dissolved in hydrochloric acid, a residue of from 15 to 20 per cent of solids, would, when mixed with sand, set under water. This residue, mostly silica and alumina, practically represented the Roman puzzolana in its chemical constituents. Although Smeaton was undoubtedly the first to discover and make practical use of this principle of hydrolicity he issued no public account of it until the publication of his report of the rebuilding of the Eddystone Lighthouse some thirty years later.

In 1791 a royal patent was granted to Mr. Parker, of London, for a cement made by calcining septaria nodules, found in the Isles of Sheppey, and in 1796 a second patent was granted him on the same subject. These nodules contained 70 per cent of carbonate of lime, 4 per cent of oxide of iron, 18 per cent of silica and 6 or 7 per cent of alumina.

As the old Roman cement was, up to this time, the only cement commercially known and as the cement produced by Parker's process closely resembled it, the new product was called "Roman cement."

In the United States, during the construction of the Delaware & Hudson canal, 1823-4, a dark blue

limestone was discovered which, when calcined and ground, produced a cement having high hydraulic qualities. Quickly following this a stone of similar nature was discovered in other places on the Hudson river, Siegfried Bridge, in the Lehigh District, West Virginia, and some other places, and various works were established during the time from 1824 to 1828.

While the American manufacturers were devoting their attention to the manufacture of this "natural" or "Rosendale" cement the English and French, and somewhat later the Germans, were experimenting on artificial mixtures of clays and limes which should produce when calcined a hydraulic cement.

Sir C. W. Paisley, an English engineer, spent much time and money in experiments with artificial mixtures but the first to obtain practical results of a commercial value was an English brick layer, Joseph Aspdin of Leeds, to whom a patent was granted in 1824. By calcining, in close kilns, a mixture of English chalk and river bed clay he produced a clinker which, when pulverized, produced a cement of extreme hardness and high hydrolicity. This cement, when made into concrete, produced a stone closely resembling the Portland building stone of England and from this the name was derived.

The first notable work in which Portland cement was used to any extent was a section of the Thames Embankment built about 1859, the specifications for which were then considered very exacting but which would now be easily fulfilled by even the lower grade cements. In 1860 official stations were established in Germany, and about the same time in some other European countries, the German experimenters being aided by the government in their researches.

It was not until about 1865 that Portland cement was used to any extent in the United States and from that time till 1875 was wholly imported from England, France, Belgium and Germany, as it was generally supposed that the chalk and clay necessary to its manufacture could not be obtained here. In 1872 Mr. O. D. Saylor, then engaged in the manufacture of a light burned hydraulic cement in the Lehigh district of Pennsylvania, noting the increasing demand for a superior cement, and the high price paid for the imported Portland, decided that a cement fully equal could be manufactured here at a less price.

At this time it was impossible to obtain any information from the foreign manufacturers, so closely were all the works guarded. After several years of disappointing experiment, hard work and many discouragements Mr. Saylor succeeded in mastering the problem and in 1875, with an associate, placed on the market a strong and reliable American Portland cement.

From this time the production of Portland cement in the United States progressed with giant strides. Our chemists, by exhaustive experiment and study, determined the exact proportions and elements which contributed to the strength and hydrolicity as well as the detrimental elements which were liable to be found in the natural rock and which must be eliminated or rendered inactive. The American inventive genius introduced new machinery and perfected the old. The former dome kilns gave place to the "rotary" and improved grinding machinery was introduced; the grinding process being so perfected that today the product is so finely pulverized that over 95 per cent will pass through a sieve having 10,000 meshes to the square inch.

As late as 1890 the importations of Portland cement into the United States was only 400,000 barrels while the domestic production was only 3,500,000. In 1903 the domestic production alone reached the figure of 22,242,973 barrels, to which should be added 525,896 barrels of puzzolana or slag cement. This enormous increase in the production of Portland cement is indicative of the adaptability of cement to many forms of construction heretofore limited to other materials.

The term concrete construction applies to a form of construction built up of an aggregate of cement and sand, or sand and crushed stone or gravel, the proportions of the ingredients varying largely with the work in hand.

While this form of construction became a lost art and was comparatively little used until about fifty years ago, there are some excellently preserved examples of early work by the ancient Romans, the most notable of which is the Pantheon built about 27 B. C. in which are yet standing walls built up of concrete and faced with triangular brick. The process followed is shown to be very similar to that of today; forms were constructed and the concrete mixture filled in, the facing being applied while the concrete was yet soft. In the Isola Bella there is an Italian garden with open concrete arches carrying a concrete esplanade built in the year 1671.

It was only about forty years ago that the discovery was made that cement concrete could be greatly strengthened by embodying therein metal and from that time to the present the characteristics of this form of construction have received the closest study.

During the past ten years many structures have been built of "reinforced concrete" but it was not until the past few years that the principle and formulas were deduced whereby the strength of such construction could be figured with any certainty.

From the first it has been known that concrete was exceedingly strong to resist compressive strength but was comparaively weak in tension; that a beam formed of plain concrete supported only at the ends would break under a comparatively light load.

Within recent years it was discovered that if a rod or bar of steel was embedded in the lower cord of this beam it would support a load somewhat above the elastic limit of the rod.

Under the applied load any tendency of the beam to sag, thereby causing an elongation of the lower cord or part, is met by the strength of the rod added to the tensile strength of the concrete and this reristance transfers a portion of the strain to the upper cord or part of the beam in the form of compression.

When steel is embedded in properly prepared concrete a combination is formed between the two and a strong adhesion exists. In addition to this adhesion of the concrete, in hardening or "setting" there is a slight contraction of the concrete about the rod and it is held with a vise-like grip.

LARGEST BOTTLES EVER BLOWN

Forty pounds of molten glass were blown and shaped into one huge bottle by the breath of one man at a big Illinois glass works recently. Hitherto the largest bottle in the world held but 20 gal.; this one is of 45-gal. capacity and there are several more like it.

The blower took the 40 lb. of molten glass on his tube and while two assistants supported the weight of the glass he blew and blew and blew without

removing his lips from the tube and until he had supplied the 11,000 cu. in. of air required. A hole was cut in the side of one of the factories in order to secure a bench of sufficient height to work the glass. The blower stood in the second story and worked the glass through this hole.

WANTED

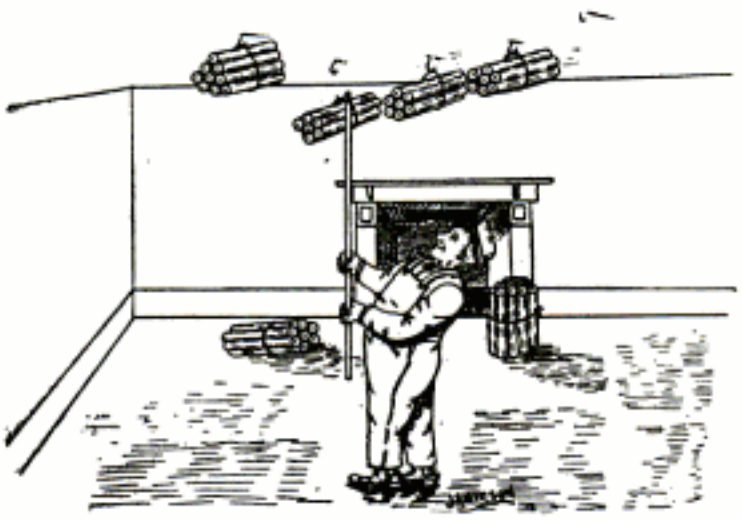
We want the names and addresses of parties who have small factories and who are looking for new things to make in their lines. Anyone sending us the names and addresses of such parties will be compensated for their trouble. Popular Mechanics Patent Bureau, Journal Bldg., Chicago.

TO OUR FRIENDS

If you have an acquaintance who has an invention and wants to know:—

1. Whether he can get a patent.
2. How much it will cost him to get a patent.
3. Whether it will pay him to get a patent.
4. How he can sell the patent after he gets it.
5. How he can get the most money out of his invention.

Tell him to write to Popular Mechanics Patent Bureau, Journal Bldg., Chicago, Ill., for free advice and information. Then write to the Bureau, and give the name and address of the inventor. You will be pleased with the results.



How Mr. Smart Hangs 130 Rolls of Paper in a Day—Western Painter

NATURE'S COMPASSES

Nature has many signs for whoever will study them. Every woodsman knows how to locate direction in the woods by noting on which side of the trees the thick moss grows, that side being north; or, if on the plains, looking at the roots, the direction in which most of them point being north. This is to give the growth a good prop against the strong north winds. One of our readers, Lester L. Ditmars, of Shelton, Conn., adds to these signs the following:

"During the last spring I noticed that the snow melted in spirals which pointed south at an angle of about 45°.

The earthquake which recently racked India so disastrously sent its vibrations around the world until they were felt even in the United States and left a record on the film of a sensitive instrument called the seismograph. The record consists of a series of irregular, wave-like lines on a strip of paper 11 yd. long and 2 in. wide. From a long straight line the record rises until it resembles a small mountain range. Dr. H. F. Reid, of the United States Geological Survey at Johns Hopkins University, says it is a splendid record of the earthquake.

CEMENT POST PATENTED

To the Editor: We beg to call attention to an article appearing in your July issue on Cement Fenceposts, by T. A. Pottinger, of Peru, Ill., from which we quote as follows: "Some use pieces of steel the shape of the section of a mowing machine knife, about five of them to steady or stiffen the wire."

We wish to state that this system of making posts is protected by patents issued to R. B. Bennett and all infringers will be promptly prosecuted. The system is known as the "Samson System of Reinforcing Concrete Fence Posts" by means of ¼ in. wire rods running the length of the post and fastened with a core plate about every 10 inches. This is found to be the only practical and satisfactory method of reinforcing a concrete fence post for the reason that it requires only one-half the amount of concrete that other posts require, thus greatly reducing the cost.

We trust you will publish this item in your next issue so that your readers may not be led to infringe the Bennett patent. Yours truly, A. D. MacKay & Co.

NEW PUBLICATIONS

ORE AND COAL HANDLING MACHINERY is the title of a handsomely illustrated catalog issued by the Wellman-Seaver-Morgan Company of Cleveland, Ohio. The evolution of machinery of this kind forms an interesting chapter in industrial progress and the new catalog describes some of the finest and most modern equipment.

NEWTON ROTARY PLANING MACHINES, published by the Newton Machine Tool Works of Philadelphia, comprises a series of illustrations of machines manufactured by that company, with a brief description of each.

IDEALS is an attractive and practical booklet sent out by A. L. Ide & Sons, 11 Broadway, New York. The ideals treated of are those that pertain to steam power plant practice and a number of suggestions along this line are offered. Ideal engines and parts are described and illustrated.

AIR LIFT PUMPING, a booklet being sent out by the Ingersoll-Sergeant Drill Co., of New York, contains some sound and valuable information, though it deals but briefly with the subject.

100,000 GAS ENGINES have been sold by the Otto Gas Engine Works, Philadelphia, and the company has just issued a very artistic and interesting booklet illustrating the features of the Otto, and reviewing its progress. To those contemplating the purchase of a gas engine, "Some Reasons Why" will be a valuable aid in making their selection, while users of gas engines generally, will be interested in the pamphlet. Mailed free on request.

ECLIPSE WINDMILLS or 1905 Catalogue No. 65C is a new publication sent out by Fairbanks, Morse & Company. The booklet gives the history of windmills in brief and then describes and illustrates the modern windmill and its parts in detail.

LAVA FOR MECHANICAL AND ELECTRICAL PURPOSES, published by the American Lava Company of Chattanooga, Tenn., describes the various uses of this material and its mechanical and electrical properties. The catalogue contains a number of illustrations.

AUTOMOBILE ENGINEERING.—We are in receipt of a sample lesson taken from the course given by the Correspondence School of Automobile Engineering. The course specializes the study of automobiles in their various phases, construction, operating and repairs. A valuable dictionary of all auto mechanical terms appears in the first lesson.

BORES A SQUARE HOLE.—A new auger intended particularly for shipyard use bores a square hole so very rapidly and so perfectly that the mortise does not require trimming. The auger is made to fit any boring machine or a special mortising machine can

Auger Bores a Square Hole

be purchased of the manufacturers. This special machine is portable and the bit can be set to cut at any angle on the timber, or endwise of the grain. The machine can be set up on a trestle or bolted to a bench.

SPECIAL MESSENGER PICKED OUT RIGHT WOMAN

A special delivery messenger at New Orleans recently delivered a letter to a woman on a crowded train whom he had never seen before, the only clue he had being the name of the woman and the train she would arrive on. The letter enclosed within a note was received at the New Orleans postoffice. The note gave the information mentioned and said the letter was important. The messenger, who had been on duty but three months, boarded the train above the depot and passed swiftly through the coaches inquiring the names of all the ladies until he found the right one.

COST OF TRADEMARKS REDUCED

Under a new law the Government has reduced its charges for registering trade-marks from $25.00 to $10.00. Popular Mechanics Patent Bureau attends to the registration of trademarks under this new law.

PATENT NOTES

Popular Mechanics Patent Bureau has connected with it more than two hundred mechanical draftsmen located in as many cities, who will make patent and working drawings for inventors and assist in developing their inventions. If you need the services of a draftsman in connection with your invention write our Patent Bureau and you will be given the address of the representative nearest your residence.

* * *

This is the time to perfect and protect your inventions by patents so that when fall begins and manufacturers take on new lines, you will be in shape to do business. Popular Mechanics Patent Bureau will send you the names and addresses of manufacturers of any kind of machinery or articles.

* * *

For a nominal fee Popular Mechanics Patent Bureau will inform you how many patents have been granted in the United States on any particular class of machines or devices, and at ten cents each will furnish copies of the drawings and specifications of any patent if the number of the patent is furnished.

WIRELESS FIRE ALARM

A wireless fire alarm system that will work automatically is being exploited by Dr. De Forest of the American-DeForest Wireless Telegraph Company and B. C. Haldeman, an electrician of Kansas City. In case of fire, the heat at a certain degree acts upon the signaling apparatus and a simple message, telling the exact location of the fire, flashes up a wire to the roof of the building, is communicated to a flagstaff arrangement and is then carried through the air to the receiver in the fire headquarters, the receiver being in tune with the transmitter.

When the message is received a bell rings and rings again until the operator receives the message in a signal code of dots and dashes, so simple that any one, though not familiar with the Morse code, can take it.

Street boxes can be used in the same manner so far as receiving the alarm is concerned, the inventors say. The message can be transmitted by pulling down a hook or pushing a button.

THIS "POP" HAD GONE HOME

One of our Chicago subscribers who began with the first issue called us up on telephone recently. The operator switched him on to the wrong number, and when he familiarly inquired, "Is this 'Pop'?" a sweet, girlish voice replied, "No, pop's just gone home, but this is Susie, won't I do?"

IT PAYS TO BE EXACT

Most of the talk is about "millions" these days, and I notice that young people, like older ones, are beginning to look down on the pennies and to imagine that saving pennies is too slow altogether for this age.

Let me tell you a true story about a recent big engineering contract that shows the value of pennies, says a Keystone correspondent.

A great firm, well-known through the country, figured on an engineering contract a few yeears ago. They had everything calculated to the last cent, except the cost of some dredging. On this they couldn't quite figure within half of one cent per cubic foot without getting more facts.

"We'd better investigate," said the elder partner, "and find out just how much we'll have to dredge."

"Nonsense," said the younger and more active partner. "It's only half a cent, and it's not worth bothering about."

So they signed the contract.

After they had worked six months it developed that the firm would have to dredge away ten million cubic feet of material. It also turned out that it would cost them exactly "only half a cent" per cubic foot more to do it than they were getting for it. Ten million cubic feet, at half a cent each, which the younger partner had said was "not worth bothering about" amounted to just $50,000.

The firm has been working three years now to fulfill a contract at a heavy loss, simply because a man didn't consider that half a cent was worth bothering about.

"Want" and "For Sale" Ads. 2 cents per word, payable in advance. Replies may be sent to a number, care Popular Mechanics, and will be forwarded promptly without extra charge.

"SHOP NOTES"—Paper covers 50 cents. Popular Mechanics.

AUTOMOBILES.

FOR SALE—1903 Oldsmobile Runabout. Write P. DeCloux, Oconto, Wis.

FOR SALE CHEAP—Touring Car equipped with Brennan motor. Car is in pink of condition excepting one front tire. Will consider $275 for it. The Starin Company, North Tonawanda, N. Y.

FOR SALE OR EXCHANGE—Big powerful Stearns Touring Car. Will sell cheap or will give good trade for smaller machine. Present car too large for owner's requirements. Photo and description on request. Box 374, North Tonawanda, N. Y.

YOU WILL find them in France, Germany, Australia, England, Canada and all of the leading factories in the United States. We mean Diamo-Carbo Emery Wheel Dressers. Our booklet for the asking. Stephan Brothers, Urbana, Ohio.

FOR SALE OR EXCHANGE—Automobile gear. Address C. C. H., 18 North Front St., Columbus, O.

FOR SALE OR EXCHANGE—4 h. p. automobile or boat 4 cycle gasoline engine. Address A. P. C., 18 North Front St., Columbus, O.

BLACKSMITHS.

EVERY USER of emery wheels should have our booklet on Diamo-Carbo Emery Wheel Dresser. A postal card will bring it to you. Address Stephan Bros., Urbana, Ohio.

GOOD BLACKSMITHS ARE SCARCE AND BUT FEW LEARNING THE TRADE.

And the smith comes first of all professions or trades. The smith must make the tools first for all, from the surgeon to the safe blower, by using Toy's Treatise on new steels explaining how to work them with 75 new methods for working all difficult jobs. Ten receipts for making your own compounds for welding different kinds of steel solid. Thermite welding fully explained; also two colored tool tempering charts: chart A explains all annealing and hardening; Chart B explains both scientific and plain tempering to a standard. All the above for $1.00. Valuable samples free. W. M. Toy, Sidney, Ohio.

BUSINESS CHANCES.

DIAMO-CARBO EMERY WHEEL DRESSER; better than black diamond. Booklet and testimonies free. Stephan Bros., Urbana, Ohio.

FOR SALE—A well equiped machine shop in southern Michigan, doing a good business. Price, $3,000. Splendid opportunity for a good business mechanic. Address No. 987, care Popular Mechanics.

FOR SALE—Steam Laundry, doing paying business; newly equipped with modern machinery; Plant worth $3,500. Will sell for less than cost. Poor health reason. New Method Laundry, Southington, Conn.

I WILL help furnish money to promote good patent. Write what you have and get terms. O'Flyng, Clarksdale, Ill.

IF YOU wish to help the company you are working for, get our booklet and testimonies on Diamo-Carbo Emery Wheel Dresser. Stephan Bros., Urbana, Ohio.

INVESTMENT BOND—I offer for sale one $500 bond in an old established business paying 6 per cent. Absolutely safe. Address "Bond," care Popular Mechanics.

START A MIRROR FACTORY in your town. There's money in it. We teach you and guarantee you success at once. Send 10 cents for sample mirror, particulars and testimonials. Do it now. None without. Hullinger's School, Francesville, Ind.

Six Thousand acres of fine timber land in Idaho (deeded) for sale cheap if taken soon. Address W. J. Ramey, Nezperce, Idaho.

ENGINES.

FOR SALE—2 h. p. gasoline engine; 8 x 8 air compressor; 8 h. p. electric motor; 1 auto sparker. J. F. Schultz, North Chicago, Ill., Box 176.

MAKE AN emery wheel any shape you wish with a Diamo-Carbo Emery Wheel Dresser. Send for booklet and testimonies. Stephan Bros., Urbana, O.

FOR SALE—3 h. p. vertical engine and 4 h. p. boiler; all fittings complete. Address A. V. Monroe, 25 Granite Street, Taunton, Mass.

FOR SALE—1¼ H. P. engine, castings for motorcycle, at a bargain. Address Box 283, Merced, Cal.

FOR SALE—4 h. p. gasoline engine, or trade for 2 h. p. Geo. F. Whittemore, Avondale, O.

FOR SALE

THE GREATEST invention of the age—Diamo-Carbo Emery Wheel Dresser; true or shape an emery wheel. Booklet and testimonies for the asking. Stephan Bros., Urbana, O.

FOR SALE—Complete arc lamp for $7.25; equal to the best, burns 160 hours at one filling, in-door or out-door, save price, 1,500 lamps in active service. Alpha Gross Electric Co., Springfield, Ohio.

TO EXCHANGE—Small turning lathe; want watch. H. Davis, Shabbona, Ill.

FOR SALE—2 H. P. 1905 motorcycle; only $125; never used. Chas. Gillivan, West Jefferson, Ohio.

FOR SALE—¼ H. P. gasoline engine complete with jump spark coil and batteries, first-class shape, $20. ½ H. P. Western Electric motor, 110 direct current, speed 1,600; $25. J. C. Faulkner, Russellville, Arkansas.

FOR SALE—500 genuine Homer pigeons, or will exchange for automobile. E. A. Cunningham, Oskaloosa, Iowa.

FOR SALE—One iron working foot-power lathe, $10; one ¼ H. P. dynamo castings, finished, $10. W. C. Schafer, 118 So. 3rd St., Hamilton, Ohio.

FOR SALE—$40; mechanical electrical engineering course (International Correspondence School). Odenwald, 1119 "H" St. N. E., Washington, D. C.

A PRACTICAL BOOK, "Dies and Diemaking." Postpaid $1. J. L. Lucas, Bridgeport, Conn.

HELP WANTED.

WANTED SALESMEN—The Tropical Oil Company, Cleveland, O., will arrange on salaried basis with lubricating oil salesmen for territory not covered; can also use on attractive commission proposition few good salesmen without previous experience in this line, which is easily learned. Communicate with us.

WANTED—Every user of emery wheels to have our booklet on Diamo-Carbo Emery Wheel Dressers, a postal card will get it for you. Stephan Bros., Urbana, Ohio.

WANTED.

WANTED—International Correspondence School pamphlets, agricultural rendering. Address "C.," Popular Mechanics.

WANTED—To exchange 1 McAlister Magic Lantern, cost $50, with good assortment of slides, poster's tickets, mechanical slides, screen lecture, etc., for gasoline engine of 1½ h. p. or castings and working drawings for same. Also good telescope for offer. Address W. R. Dine, Zoar Station, Ohio, Box 27, Tuscarawas Co.

WANT TO exchange No. 2 Remington typewriter for electrical testing tools or gasoline engine. Offer something. O. A. Prest, Clinton, Iowa.

POSITIONS WANTED.

POSITION WANTED as oiler in a steam plant of medium size furnishing power for electric machinery. Address L., Box 211, Manhattan, Kan.

MISCELLANEOUS.

WANTED—Painters to learn sign-painting by our new method of cut card boards letter patterns. Send stamp for samples and circulars. E. T. Littlefield, Adams, N. Y.

TYPEWRITER—Cost $100, good as new; will exchange for motor-cycle. C. S., Box 23, Waynesville, Ohio.

STEEL STAMPS—Brass stamps, door plates, wax seals, embossing dies, brass printing cuts, notarial seals, photographers' stationery, sheet metal, dies and presses. J. Kiola, engraver, 155 W. Madison St., Chicago, Ill.

FOR SALE—One 12-light 110 V. D. C. dynamo, used 500 hours, good as new, with rheostat, for $25; a bargain. Alpha Gross Electric Co., Springfield, O.

THE WONDER OF THE AGE—Diamo-Carbo Emery Wheel Dresser, booklet and testimonials free. Stephan Bros., Urbana, Ohio.

TO TRADE—Small invention for light runabout. Fred Kiser, Pittsfield, Ill.

FOR SALE—One enterprise saw rig, practically new. Write for price and descriptions. J. C. Merryman, R. F. D. No. 4, Cadiz, Ohio.

TRUE OR SHAPE emery wheels in any shape you wish with a Diamo-Carbo Emery Wheel Dresser; booklet and testimonials free. Stephan Bros., Urbana, Ohio.

BRAINS FOR SALE—Do you want a prospectus written and illustrated for your new company or syndicate? Do you want one that will command attention and sell shares? Do you need a catalogue or booklet that will not be thrown in the waste basket? If so write to Expert, care of Popular Mechanics, Journal building, Chicago.

CAMERA FOR SALE—Vive camera, 3¼x3½ in., in good condition, $3. C. L. S., Popular Mechanics.

ADVERTISING COURSE FOR SALE—Full course of lessons from the foremost school in the country. Price $10. C. L. S., Popular Mechanics.

WHEN YOU WANT anything and don't know where to get it, write Popular Mechanics.

WANTED—If you have anything in light metal manufacturing, job or experimental work, write me. Lowest prices. Schwabe & Son, 55 W. Washington St., Chicago.

ATTENTION MACHINISTS and carpenters. We wish to let you know that we carry a full line of mechanical tools of all descriptions. We are giving the readers of Popular Mechanics an opportunity to get good tools at cut rate prices. We carry all makes. Write for one of our 6 in. hook rules, price 60 cents. Send for catalogues. Eureka Tool Supply Co., Wilkinsburg, Pa.

A PRACTICAL BOOK, "Dies and Diemaking." Postpaid $1. J. L. Lucas, Bridgeport, Conn.

ENGINEER'S LICENSE—Engineers, electricians, firemen and machinists, send for free pamphlet describing Spangenberg's Steam and Electrical Engineering; 672 pages; 648 illustrations; 1,035 questions and answers; just out; best book ever published. Geo. Zeller Book Co., St. Louis, Mo.

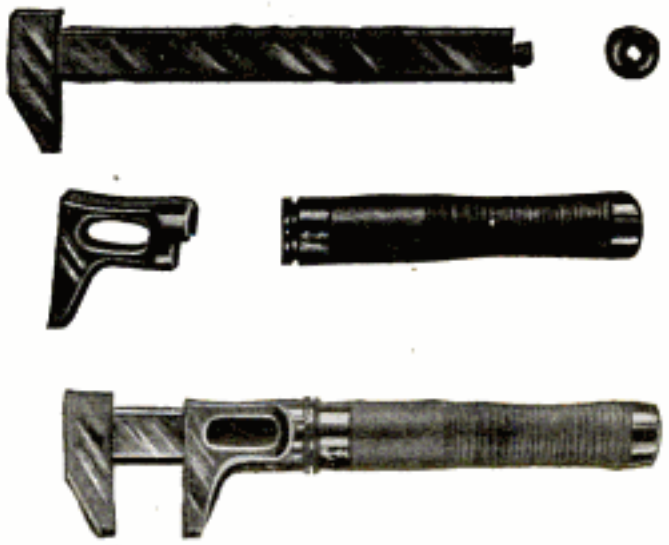
Railroad Building in 1905

There are 7,000 miles of railroad track under construction in the United States, of which 3,500 will be completed this year. Up to June 30, 1,284 miles have been finished, which the Railway Age says is divided as follows:

There has been no track laid thus far in the New England States, although one line 65 miles in length and several shorter extensions are under construction in that region. In other groups of states the figures of new track are as follows: Middle states, 57.56 miles; central northern states, 83.28 miles; South Atlantic states, 251.87 miles; Gulf and Mississippi Valley states, 242.98 miles; southwestern states, 297.2 miles; northwestern states, 138.6 miles; Pacific states, 213 miles.

Over one-half of the track laid is located in the South and Southwest, where the new mileage aggregates 792 miles.

PETRIE INSTANTANEOUS WRENCH.—This wrench is adjusted in one-eighth the time usually required in setting the ordinary monkey wrench. As the average employe using a wrench ranges from the fairly well paid up to the most expensive machinists, the actual saving in time and consequent dollars is something which can be reduced to figures, being estimated at from 25 cents per day up. The tool is extremely simple, having only three parts and a washer. A slight turn of the handle releases head which pulls out, thus increasing the leverage instead of lessening it as in the ordinary wrench. When adjusted a slight turn of the handle sets the jaw absolutely; it is impossible to cramp the jaws. The parts are steel, handsomely polished; price same as ordinary wrenches of equal size.



Parts of Instantaneous Wrench

Boys

When my dad talks to me 'n Gus,
'Bout when he was small, like us,
  He was the best boy ever yet:
  'N never got his shoes all wet
A-walkin' through 'most ev'ry pool,
When, rainy days, he went to school.
  He never was as bad as us,—
  When daddy talks to me 'n Gus.

He never scrapped with Uncle Jack.
'N never, never put a tack
  In people's chairs; 'n, not like me,
  Was prompt at dinner, breakfast, tea.
He never swiped a jar of jelly;
N'r never called his stummick "belly."
  He never tried to smoke 'n cuss,—
  When daddy talks to me 'n Gus.

He never pinched his sister's cat,
'N put black beetles in her hat.
  He never broke the baby's toys:
  'N when he played, he made no noise.
But sometimes, Uncle Jack 'n he
Smoke 'n rec'lect things, after tea,
  'N what they say, don't sound to us,
  Like when dad talks to me 'n Gus.

—Hilda Hasse.

INSTRUCTIONS FOR LIFE-SAVING FROM DROWNING

Summer Bulletin the U. S. Volunteer Life-Saving Corps.

A large proportion of the lives lost every year are of children who have never been given any conception of the dangers on the waters, either in bathing or boating. We have been long and persistently urging upon parents and School Boards the duty and necessity of education in this direction, and of teaching the young how to swim and how to act when boating.

As a result many lives have been saved the past year by children. Let us kindly impress upon your readers these rules:

FIRST.—Do not go out in any pleasure boat of small or large dimensions without being assured that there are life-saving buoys or cushions aboard sufficient to float all on board in case of an upset or collision, or festooned with life-saving ropes.

SECOND.—With a party, be sure you are all properly and satisfactorily seated before you leave the shore—particularly so with girls on board. Let no one attempt to exchange seats in mid-stream, or to put a foot on the edge or gunwale of the boat to change seats, or to rock the boat for fun. This, by rollicking young people, has upturned many a boat and lost very many lives every year. Where the waters become rough from a sudden squall or passing steamers never rise in the boat, but settle down as close to the bottom as possible, and keep cool until the rocking danger is past. If over-turned, a woman's skirts, if held out by her extended arms, while she uses her feet as if climbing a stairs, will often hold her up while a boat may pull out from the shore and save her. A non-swimmer, by drawing his arms up to his sides and pushing down with widely extended hands, while stair-climbing, or treading water with his feet, may hold himself up several minutes, often when a single minute means his life, or throwing out the arms, dog-fashion, forward overhand and pulling in, as if reaching for something—that may bring him help, may at least keep him afloat till help comes.

THIRD.—In rescuing drowning persons, seize them by the hair or the collar, back of the neck; do not let them throw their arms around your neck or arms. If unmanageable, do not strike them, but let them drop under a moment until quiet, then tow them into the shore. If unconscious, do not wait a moment for a doctor or an ambulance, but begin at once; first, get the tongue out and hold it by a handkerchief or towel to let the water out; get a buoy, box or barrel under the stomach, or hold them over your knee, head down, and jolt the water out, then turn them over side to side four or five times, then on the back, and with a pump movement keep their arms agoing from pit of stomach overhead to a straight out and back fourteen or sixteen times a minute until signs of returning life are shown. A bellows movement pressure on the stomach at the same time is a great aid if you have help. Of course, you will at first loosen collar and all binding clothing. Let some one at once remove shoes and stockings, and at the same time rub the lower limbs with an upward movement from foot to knee, occasionally slapping the soles of the feet with the open hand. Working on these lines our volunteer life-savers have been successful after two hours of incessant manipulation, but are generally successful inside of thirty minutes. Spirits of ammonia to the nostrils, or a feather tickling in the throat, often helps to quicken, but we rarely need anything more than the above mechanical means. Use no spirits internally until after breathing and circulation are restored, then a moderate use of stimulants or hot tea and a warm blanket or bed is of the first importance.

The U. S. Volunteer Life-Saving Corps has distributed several thousands of its illustrated "Rescue and Resuscitation Cards," through its life-saving members, and, per mail, it will furnish them to any one on receipt of the cost of postage and mailing tube, five cents. But if any of your readers will cut out this article from your paper and study its instructions and carry it with them, they will be able to meet any emergencies that may occur upon the waters.

Whenever, in any state, or any water-ways, where people gather for swimming or boating, three or more expert swimmers will form a volunteer life-saving crew, we will furnish them, free of expense to them, life-saving buoys and flags and signs to designate their station, and button and badges to denote their official positions, and also boats and medicine chests where needful containing all remedies to resuscitate the drowning, at half their cost.

Free lectures (illustrated), giving the entire history of the life-saving organization, will be given by its officers wherever desired.

J. WESLEY JONES,

President and General Superintendent of the U. S. V. L. S. C. General offices, where all inquiries for information of life-saving work or formation of life-saving crews in any state may be addressed, 63-65 Park Row, New York City.

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If you have made an invention and contemplate applying for a patent, the first point is to learn whether your idea is new and patentable. Do not depend on the fact that you or your friends have never seen anything of the kind. Send us a pencil drawing, showing plainly your invention, and write out a description of its construction and operation, as well as you can. If you have a model, send it instead of the drawing. We will compare your sketch or model with all patents issued in the United States for inventions resembling yours, and for inventions in which similar mechanical constructions or principles are used. If a patent is found for an invention exactly like or closely resembling your idea, we will send you a copy of such a patent. If nothing is discovered to prevent getting a patent for your invention we will so advise you.

The charge for this service, unless otherwise agreed upon by special arrangement, is five dollars. This examination is an important step in connection with every patent application and requires great care and skill. An incompetent attorney may overlook a patent which closely resembles or completely anticipates your invention, or he may not know where to look. A dishonest attorney will purposely fail to find an anticipating patent in order that he may get the fee for preparing the application. The inventor is the loser in either case.

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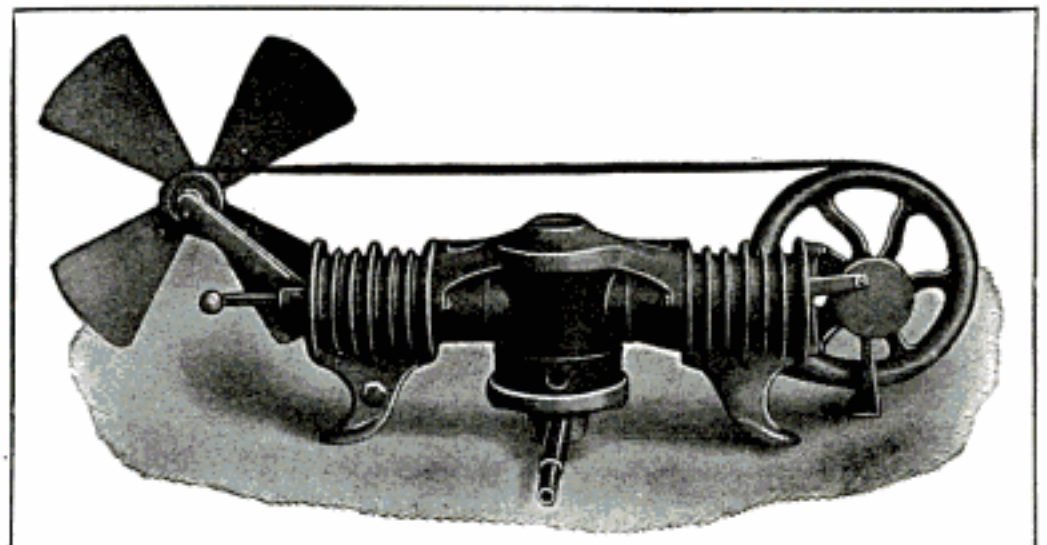

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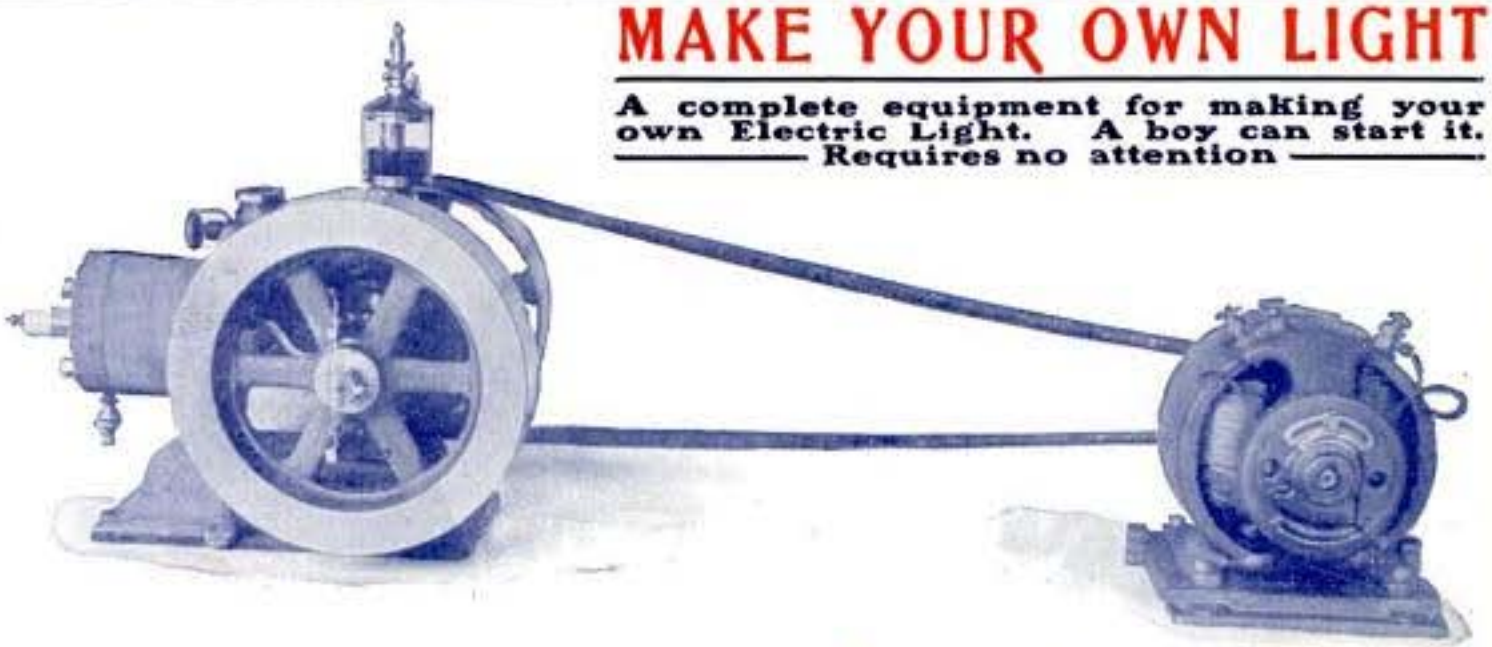

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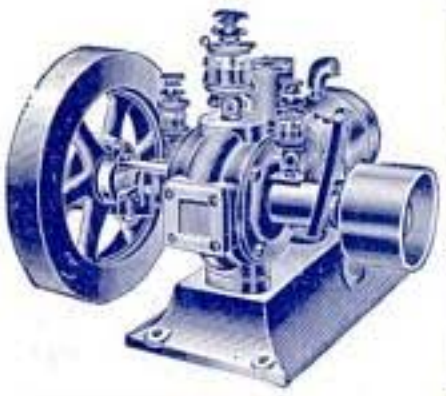

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